99'er HOME COMPUTER magazine

Covering the Texas Instruments Brand of Home Computers

October, 1983 $3.50 in U.S.A.

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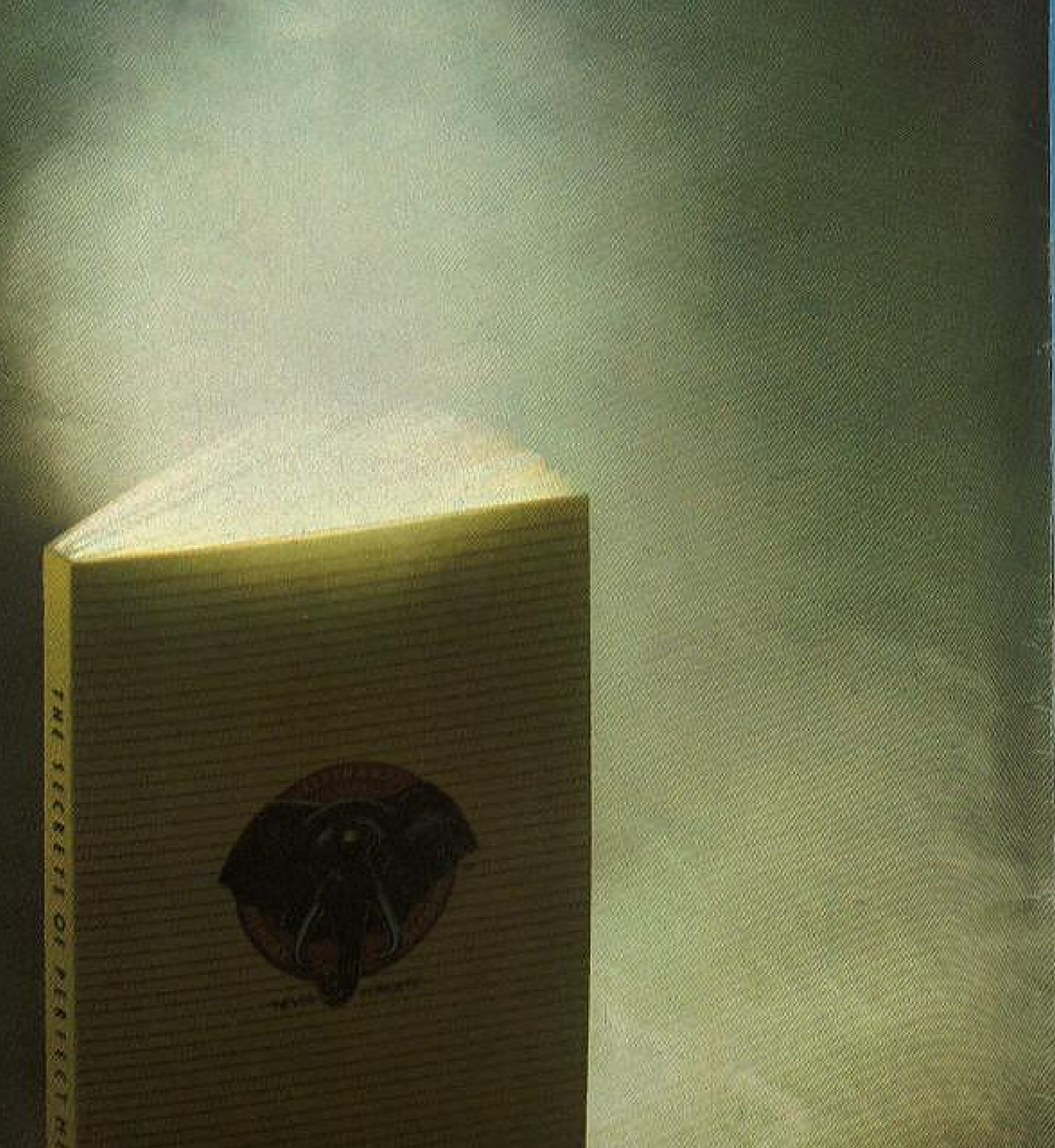

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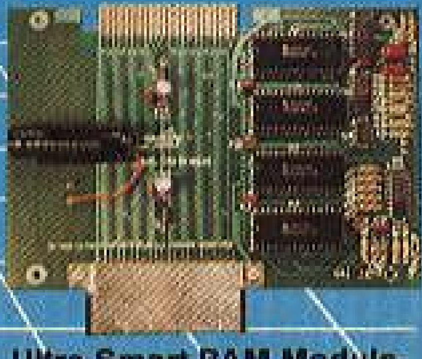

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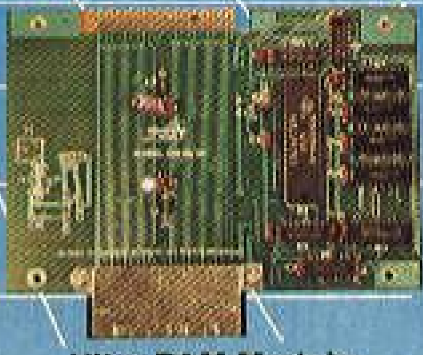

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"Although most of the game has been played by fourth quarter, that's usually the time when the real action takes place . . ."

By Gary M. Kaplan
Publisher & Editor-in-Chief

Whether in football or the consumer electronics industry, there's something magical and climactic about the all-important fourth quarter. Although most of "the game" has been played by this point, it's usually in the final period that the real action takes place—the pressure plays and last-minute gambits that ultimately determine just who the winners and losers will be.

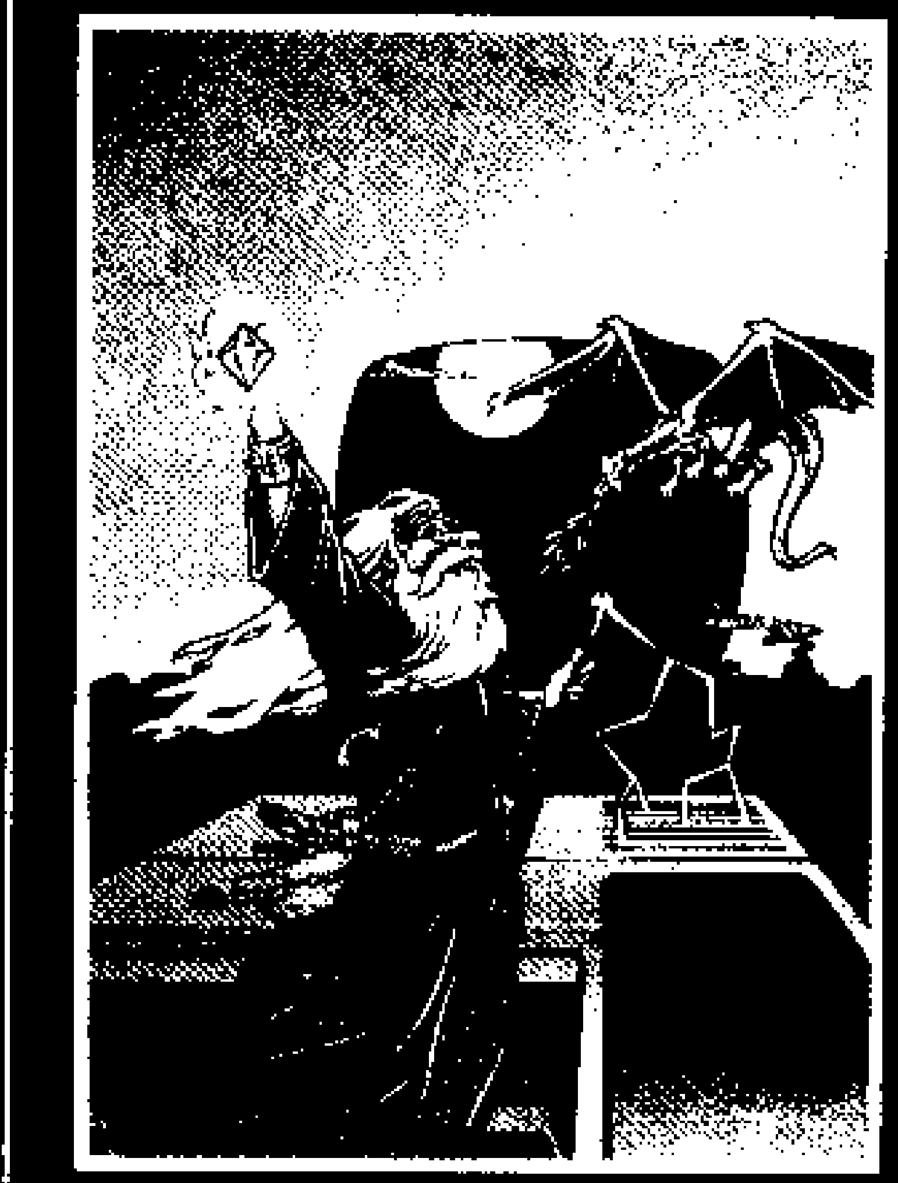
As the season changes from summer to fall, a "back to school" and "back to work" mindset takes over and sends us scurrying back to our reliable home computers in search of new indoor learning and fun. Not coincidentally, this is also the time when a lot of exciting new hardware and software products are announced and shipped. And products that have previously been announced with great fanfare finally get produced, shipped, and placed on retail shelves in time for the big Holiday buying spree. Yes, it's a time when veteran computer users add on to their systems, and myriads of shoppers catch their first case of home computer fever and join our swelling user ranks.

I think it therefore appropriate that we here at *99'er HCM* have launched our own fourth-quarter magic with this October issue's theme of Fantasy and Adventure. In our concerted effort to demonstrate that a Home Computer can do so much more than "just play games," we've not had a game cover and theme since the Volume 1, Number 4 issue nearly two years ago! It's high time, then, that we examine the role-playing fun and excitement that can be yours with this magical machine.

Fourth quarter is also the time when those of us working here alongside the beautiful Willamette River at the end of the famous Oregon Trail must start planning for blazing new trails during 1984. We've recently undergone a major corporate reorganization to facilitate our rapid growth and increased levels of both reader and advertiser service. Some editorial staff whose names are familiar to this magazine's readers—David Brader, William ("Kelly") Balthrop, and Sharyn Lyon—have assumed new responsibilities in the offices of our Corporate Research Center (CRC). Sharyn, however, will still be apportioning some of her time to serve as the magazine's Educational Editor. And although Dave and Kelly will no longer be on the magazine staff, we'll benefit from having their technical expertise close at hand. I suspect that you'll also be seeing an occasional article from this dynamic duo. Associated with Dave's move over to head up CRC, Robert Ackerman (of Compact Computer series fame) has been slated as the magazine's new Managing Editor.

Next month's issue will appear "smack in the middle" of the fourth quarter. We expect to have some very exciting product news for you at that time, when "the game" really starts to heat up. In fact, we expect it to grow progressively hotter as the days grow shorter and colder.

And as we put in more "TV time"—shared between our Home Computers and our favorite football teams—we at *99'er Home Computer Magazine* offer you solace for the harsher realities of an approaching winter with a variation on the popular commercial jingle, "If you've got the time. . . we've got the (high-tech) cheer."



HOME COMPUTER
magazine

From the inspired palette of staff artist Laredo comes a venerable wizard who has made a bold move from his usual haunts of sorcery into the world of Home Computing. His enchanted sceptre sends bolts of creative imagination into the computer. He, in return, is charged with the spirit of modern technology. In these pages we present the union of these mystical and technological worlds, and we hope that you too will be inspired by the spirit of fantasy and adventure. When it comes to Home Computing we are involved in a perpetual adventure where today's fantasy is tomorrow's reality.

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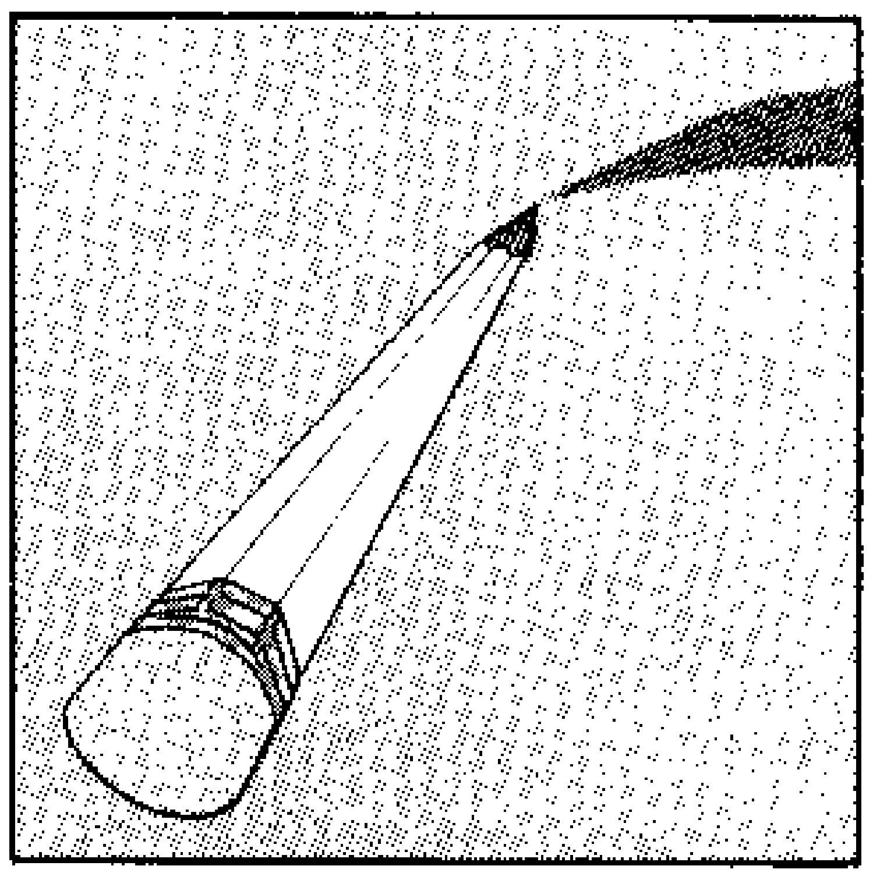

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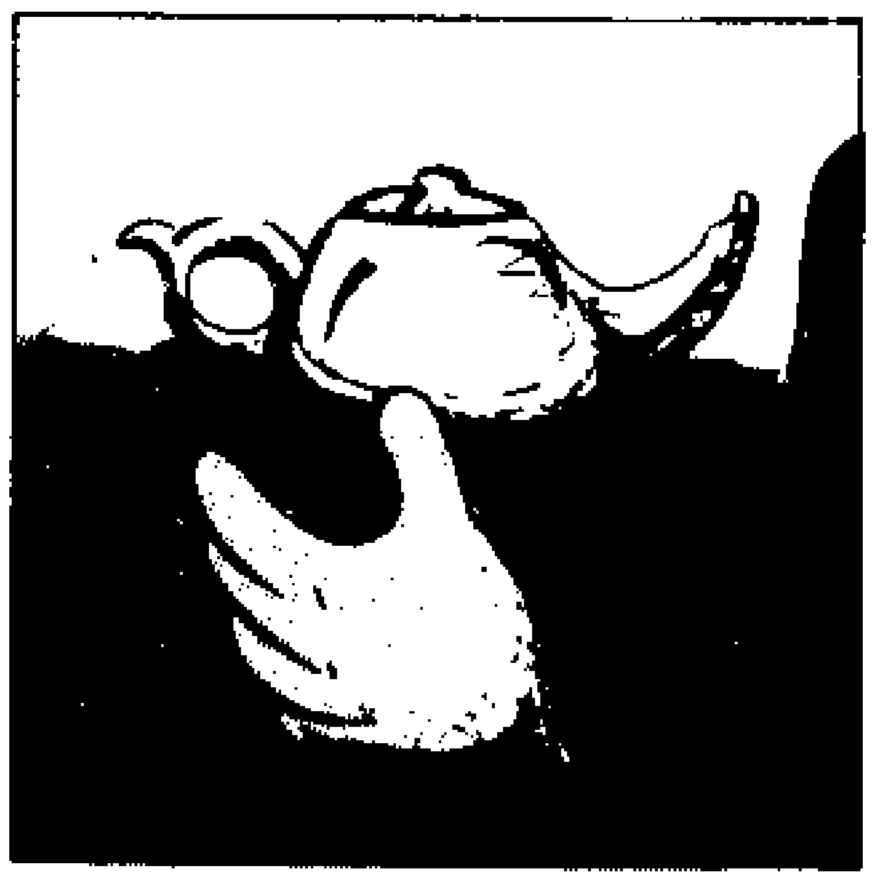

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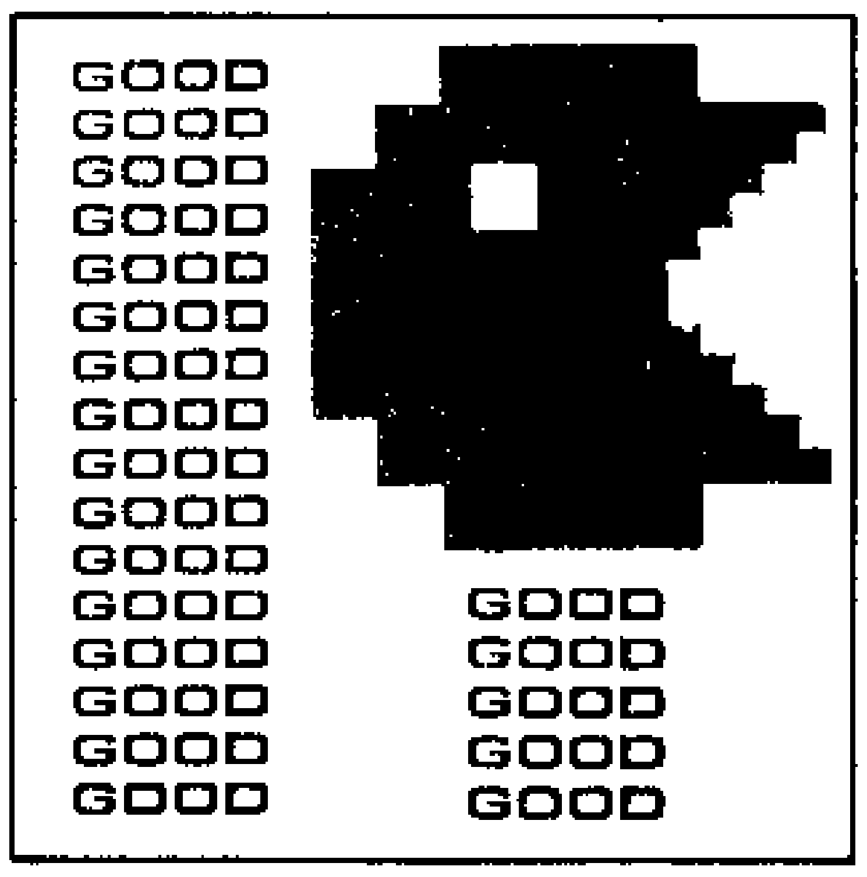

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INSIDE 99'er

Occult October comes in on blustery breezes, bringing the supernatural forces of the season. There's no escaping them—they're everywhere. Yes, they are even in your Home Computer! But don't be frightened—*99'er HCM* has temporarily tamed some of these spirits for you. Perhaps this year instead of going to Bald Mountain to dance with representatives of the dark side of the spirit world, or sitting in a pumpkin patch dutifully awaiting the arrival of the Great Pumpkin, you may choose to convene with your console, trusting these pages to guide you safely through the dominions of Fantasy and Adventure.

A fancy adventuring idea takes us to the Middle East in *Desert Dilemma*. What's that—you'd rather go to Australia? Well, that can be arranged because the story in this BASIC program is a do-it-yourself tale that you can make up anew whenever or wherever the spirit moves you.

Spirits, libations and concoctions of all kinds fall into the realm of our mystic *Multiplan Medium* this month. Yes, our sage is back with some smooth and intoxicating ways to use this versatile software for pleasure as well as business.

Our LOGO turtle gets right down to business showing young and old what his language can do in *Turtle Strut*. Then, to prove he's not "all talk and no action," this intrepid terrapin goes on a LOGO text adventure in *Once Upon a Tortoise Shell*.

Heroes are the order of the day, as you join up with *Les Izmore and DeBug* on their comic strip adventures. In their maiden voyage, Les and his clever chameleon visit Djunkiardia to save the fortune of this tiny country as well as that of a slick and slightly sleazy arcade owner.

Does this sound like a complicated plot to you? Maybe so, but the CC-40's four color printer-plotter has *Lots of Plots* to present that will delight fans of this mighty little 8-bit computer!

Two bits, four bits builds us a *PicoProcessor*—an imaginary yet instructive machine with an accompanying BASIC program that is bound to enlighten us about the inner mysteries of what makes our computers RUN.

While you're running, how about jogging by TI with us to check out one of their educational game cartridges. *Hangman* not only helps you get the most out of this cartridge, but also shows you a way to use it at home and in the classroom. *Number Nibbler* is another program that is at home in both the classroom or the family room. This Extended BASIC tidbit will help preschoolers learn math concepts while they're having fun with familiar friends.

If you'd like some pure and simple fun with your computer, then *Make Your Mark* is what you need. This BASIC program lets you create doodles in all shapes, colors and patterns. Impress your friends with intricate designs on your CRT.

The intricate world of Super Language is clearly defined in *Have No Fear: Assembly Language Won't Byte!* This gem offers beginners an informative adventure into TI's Mini Memory cartridge.

A big game hunt will take you to the bear's lair in *Grisly Adventure*. This two-screen, BASIC game is fast-moving and challenging. Once you have shot the rapids, you'll have to shoot the bear before he gets to you. If you can keep the appropriate distance, you'll have it made!

Keeping track of your distance and direction is a must if you intend to *Escape from Wizard's Keep*. The maze is complicated, so you'll need to believe in magic or make a map if you are to succeed in this Extended BASIC fantasy.

The supernatural forces represented by these articles and our regular features are really friendly ones. So when you're considering what you are going to do for Halloween, don't forget all the places you could go and the things you could become just by sitting safe and warm next to your comfortable little computer console. It would be a treat to see what tricks you could come up with together, wouldn't it?

Until next month, have fun reading, learning and RUNing!

Last month, the Multiplan Medium took a vacation. This month, our TI-WRITER and PLATO pedagogue are taking some time out before winter sets in, but they'll return next month.

LETTERS TO THE EDITOR

TI-WRITER TRANSLITERATION

Dear Sir:

I was intrigued by your response to a letter in your July issue. In that issue you stated that *TI-WRITER* will access any feature of the printer which is being used. Although I am writing this with the *TI-WRITER* and the Epson RX-80, I have not been able to access solid underlining, superscripts, or subscripts—let alone italicized, condensed, etc! And after a call to TI Tech Support which gave a resounding "not possible," I gave up. Please share your secret!!

William Oberle
Baltimore, MD

The response from TI Tech Support seems a bit odd, because you can use any of your printer's software control codes from TI-WRITER. You can implement them using either the Special Character Mode (p. 98 of the TI-WRITER manual) or the TRANSLITERATE (.TL) command for multi-character control codes (p. 107 of the TI-WRITER manual). To insert the character which starts double-width characters on our Gemini-10 printer, for instance, we type [CTRL][U] and then [SHIFT][N]. This puts the symbol ė *in the TI-WRITER file. To insert the Gemini-10 control codes to start underlining, we have to transliterate those codes into a single character for the Text Formatter to read. A seldom-used character, like the accent grave ('), is good to use. The following formating command transliterates the sequence of codes for underlining on the Gemini-10 (ESCAPE, ASCII 27; minus sign, ASCII 45; 1) into the accent grave (ASCII 96):*

```
.TL 96:27,45,1
```

After this command, every time the Formatter encounters an accent grave, it recognizes that character as a format command only. It doesn't print that character; rather, it sends the ASCII characters designated in the TRANSLITERATE command to the printer.

After reading your manuals carefully, you will then have to experiment with the use of these commands in conjunction with your particular documents and your printer in order to make the best use of them.

Sorting It All Out

Dear Sir:

I would like to thank you for your fine magazine and the clearly written articles in it. I am a farmer by trade and a self-taught programmer. Having had no formal training in programming, sort routines were a total mystery to me. Mr. Doug Hapeman gets my vote for best article in your July issue for his article "Never Out of Sorts." It was a real eye opener for me.

I may have discovered the second biggest mistake TI has made (number one was the old 99/4 keyboard). I use the *Checkbook Manager* software package for my farm records. The SORT1 routine contained in this package takes an eternity to run. In looking over a listing of the program, I discovered it contained a Shell sort and a bubble sort but only used the Shell routine. This is the best choice if your entry numbers are not in order. But if you use the check number as I do, the file does not require much sorting, as the check numbers are in sequence. By adding the following five lines to the program, the bubble routine becomes available as a selection option, and the sort time can be reduced to approximately two minutes for 100 entries—instead of fifteen for the shell sort.

```
880 RESTORE 200
890 READ T1$,T2$
900 PRINT :::T1$:::
910 INPUT T2$:SM
920 IF (SM<1)+(SM>2) THEN 910
```

Line 1130 must be changed to read:

```
1130 ON SM GOSUB 1190,1700
```

I don't understand why TI missed this when they altered the disk sort program to accommodate the *Checkbook Manager* package. This small change saves a lot of sorting time.

Robert Stell
Baldwinsville, NY

This is just the sort of informational letter we like to see, Robert. We're glad you decided to shell out with this program fix, but we hope you didn't burst anyone's bubble on TI's programming staff.

If readers have the inclination to make this fix, they should be sure that they keep their data files in the same way—close to check number order. If that's not the case, the bubble sort will take much longer than the Shell sort, and they won't have gained anything.

More Sprites

Dear Sir:

While going through older issues of *99'er* recently I noticed that David J. Brzuchalski, the author of "Say and Spell" (March, 1983, p. 13), complains that he spent " . . . several hours shading hundreds of little squares . . . " in order to get a magnified set of characters for his program. Here is a program in Extended BASIC which does the job. It accepts as an input a character and displays that character magnified, the defining string for the character, and the defining string for the magnified character (64 characters long). The DISPLAY AT statements in line 140 put the newly-defined characters on the screen in the same locations as a sprite called with the MAGNIFY(2) statement. The program also demonstrates a use of logical operators directly on numbers (see p. 43 of the TI Extended BASIC manual). Here is a listing:

```
100 DEF D$(X)=CHR$(3*X+6.5*(X AND
    2)+48)
110 DEF CD(X$)=ASC(X$)-55+7*(ASC(X$)
    AND 32)/32
120 F=0 :: R$="" :: INPUT I$ :: CALL
    CHARPAT(ASC(I$),J$)
130 FOR I=1+F TO 16 STEP 2 :: M=CD(SEG
    $(J$,I,1)) :: R$=R$&RPT$(D$((M AND
    12)/4)&D$(M AND 3),2):: NEXT I :: IF F
    THEN 140 :: F=1 :: GOTO 130
140 CALL CHAR(97,R$) :: CALL CLEAR ::
    DISPLAY AT(8,7):CHR$(97)&CHR$(99)
    ::DISPLAY AT(9,7):CHR$(98)&CHR$
    (100)
150 PRINT J$:R$ :: GOTO 120
```

Function D$ returns for either 0, 1, 2 or 3 characters 0, 3, C or F respectively, i.e., hexadecimal digits which correspond to pixel sequences with a doubled number of on and off pixels. The expressions (X AND 2) have a value 2 for 0 and 1, and a value 2 for 2 and 3. The function CD returns a decimal value of a hexadecimal digit. The strange-looking expression

Continued on p. 58

Entering 99'er Programs

New readers should be aware that within the magazine's pages are found actual computer programs that *you* can put into your Home Computer and enjoy.

Make sure you have any special system components required by the program (e.g., the Speech Synthesizer, Extended BASIC cartridge, etc.). Then, using the console keyboard, you can type the printed magazine listing (character for character, and line by line) into the computer's memory.

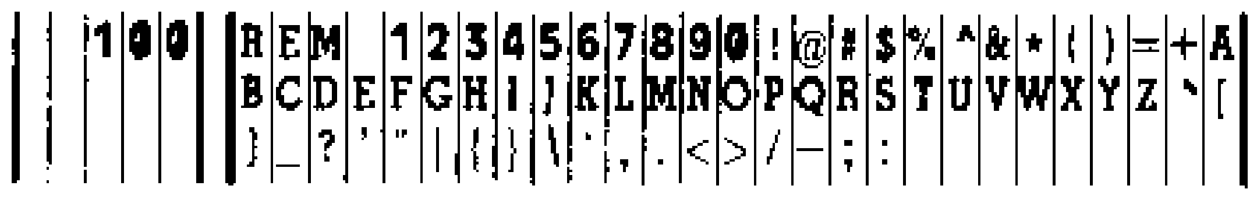
Before entering the program, connect a cassette recorder to the computer. Make sure you have two blank cassette tapes. For each 10-20 lines you type in, use SAVE CS1 to save that program segment onto one of the tapes. Alternate between the two tapes each time you save the program. Be sure to rewind to the beginning of each tape before saving, so that you always record over and replace the shorter segment of program lines with the longer segment. By following this procedure, you'll always retain most of your work even if the lights go out or someone turns off the computer.

Double check your typing against the program listing for errors, and *then* have someone else check it. The most common errors are typing the letter "O" instead of the number "0" (zero)—they are *not* interchangeable to the computer. This is also true for the letters "I" and "L" and number "1" (one). See "Key-In Reference"

Every time you make a correction to your program, SAVE CS1 and switch the tapes. Once all the errors are corrected, you will have a good copy of the program on the last tape. Before turning off the computer, put the other cassette tape in your recorder and once again SAVE CS1. Now, if one tape gets damaged, you won't have to enter the program listing via the keyboard all over again. Have fun and happy computing.

Programming Conventions

KEY-IN REFERENCE



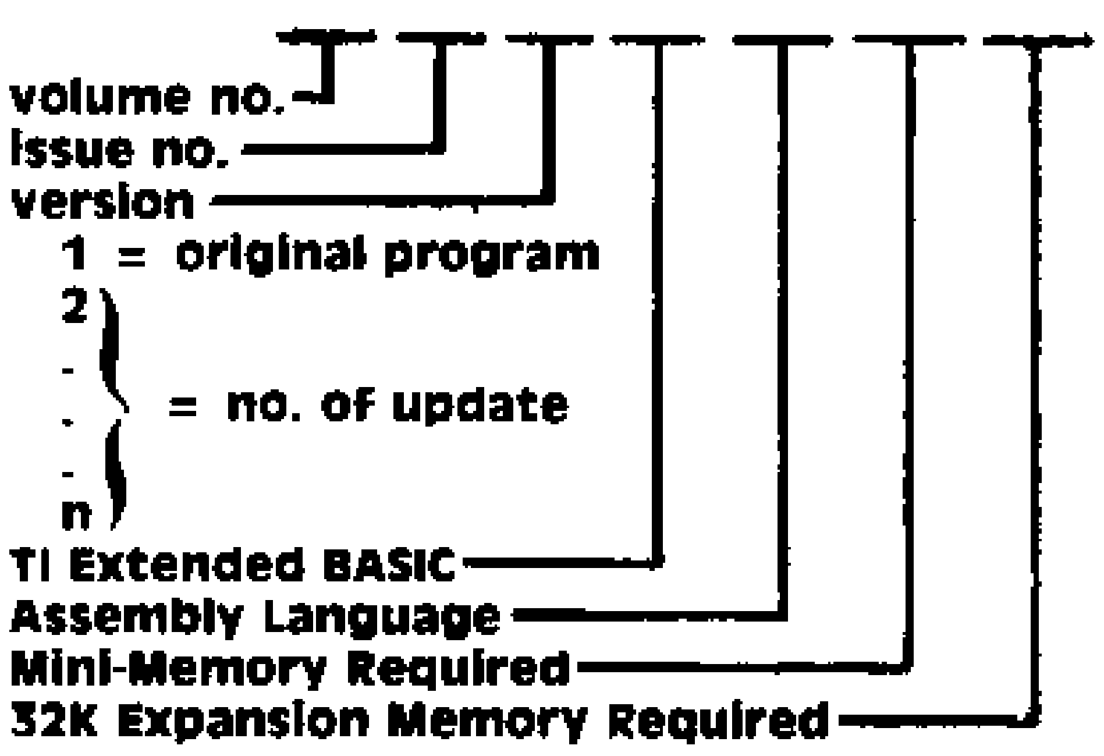
1 0 0
R E M 1 2 3 4 5 6 7 8 9 0 ! @ # $ % ^ & * ( ) = + A
B C D E F G H I J K L M N O P Q R S T U V W X Y Z ` [
] _ ? ' " | { } \ ' , . < > / − ; :

=End of Program or Article

compu-prestidigitation

(kóm·pū·prĕs·teh·dĭ·jeh·tā·shŭn) —*n.* **1.** The magical quality of unexpected comprehension that results from presenting technical information about computers in a lively, entertaining, visually attractive and easy-to-understand format. **2.** The magical tricks that make a computer sing, dance, and do all sorts of wonderfully useful things.

99'ER VERSION



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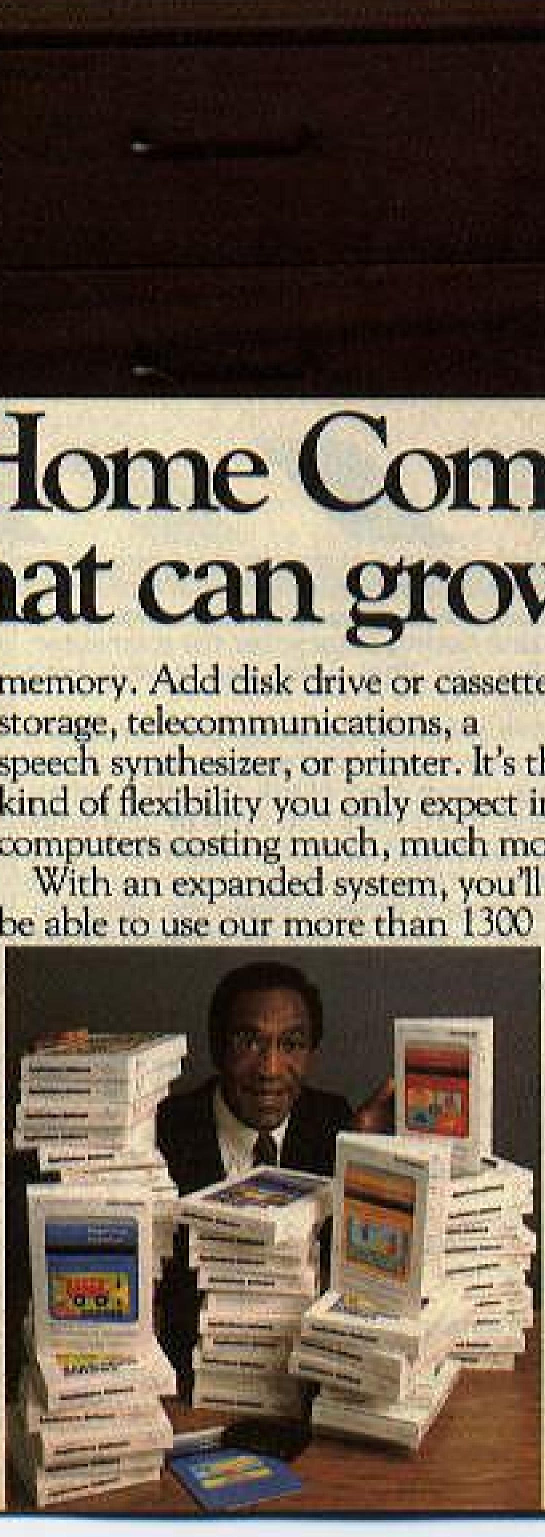

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DESERT DILEMMA

A Do-It-Yourself Adventure

by James Schwartz
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Recently a new genre of literature has appeared in paperback. This new form lets readers decide, to a limited extent, how the story will turn out. It does this by using a technique very familiar to computer programmers. The reader reaches a point in the story where there are two alternatives. ("Should Joe look inside the cave or should he keep going?") The reader makes a choice and is directed to the page on which to continue reading.

This new form of story seems tailor-made for home computers. With the application of these underlying ideas, we can begin to explore the field of computerized participatory literature.

The purpose of this article is to show how to create a participatory story. The program provided and the instruction given here will focus on text-only stories. Future articles will take up stories incorporating graphics and sound. The program used here is structured for user-written stories. The *Desert Dilemma* is offered as a sample of what can be done.

The major task of the program is to present text which gives the reader a choice of action. The reader's choice leads to more text and choices resulting from the specified action. (In this type of program it is essential to write the entire story including all possible plots and endings, before starting to program.)

The heart of the program is in lines 160 to 420, which search through string data to find and present specific sections of the story. The input statement (used with a null prompt to suppress the question mark) on line 230 receives directions from the reader. Line 270 then reads a string from the data list, and line 280 determines whether that string matches the input string. (The title of each story section is stored immediately ahead of its text segment, and it acts as an index for locating correct text.) When the match is located, lines 340 through 370 read and print the entire text of the appropriate story segment. The end of a story segment is marked by 000 in the data list. When the 000 code is reached, control returns to the input statement and the process repeats.

Some segments are story endings. When an ending is reached, control should not be sent back to the "listen and test" routine. The XXX string in the data list signals a story ending. When this string is reached, the program executes the end routine on lines 460 to 540.

The very last string stored in the data list is ERR. This string will never be reached unless the user has input a word that is not one of the story segment titles. If this error does occur, line 290 will transfer control to the error message sequence on lines 420 to 450.

As the story progresses, the program should prevent illogical jumps to previous story segments. In this program, line 310 stores each used story segment title in an array (USED$). Each time the user enters a choice of action, lines 240 to 260 test to see if that story title has been used before. If so, the error sequence is activated.

For each story ending, an opportunity is provided to begin again. If this choice is taken, it is necessary to empty the USED$ array before beginning again. The loop in lines 510 to 530 accomplishes this.

Do-It-Yourself

Because the greatest value of this program is its ability to present an infinite number of user-written stories, let's look at the method for putting a new story into the program. The data statements beginning at line 660 are the key to this.

Each data statement contains up to four lines of text to be presented on the screen. Each line of text is considered as one element of data and is therefore read as a unit. Because of this, it is necessary to limit each unit of data to 30 characters in order to avoid undesirable screen wrapping.

Typically, each segment of this story has a one-word title. A prompt puts this title on the screen when the preceding story segment is presented. This title is also included in the data list, and as explained earlier, acts as an index for the program to locate appropriate segments.

> **"The job of creating a story need not be a project for the individual, but may be a perfect task for groups."**

Finally, each story segment must be followed by the code string 000 to signal the end of the segment. Futhermore, if the segment is also a story ending, the 000 must be followed by XXX.

At this point, we should note that the story introduction requires different handling from the story segments. The program should display this initial screen whenever the program runs. For this reason, the initial screen uses PRINT statements in a subroutine on lines 550 to 650.

Now we are ready to build an actual story segment into the program. We've already composed the story segment itself on

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paper and given it a one-word title/index. Next, beginning on line 660, we write a DATA statement, which holds the title and the first three lines of text separated by commas. (In writing these data lists it is important to note that each DATA statement holds no more than 105 characters. If only part of a line of text fits on the end of a data statement, it is better to remove that partial line and use a new DATA statement. This prevents unwanted wrapping of text.) We continue writing text lines in data statements in this way until the end of the story segment is reached. At that point, we insert the code 000 to finish this segment.

We can immediately follow the 000 code with the next story title and story segment. This process would then continue until we'd written the entire story. Each story ending must be coded with XXX after the 000 which signals the end of the segment. The ERR code must be placed at the very end of the last data statement.

Who Writes the Story?

Some users may hesitate at the prospect of creating an original story with alternative plots and endings. This is where, with some imagination, a group of friends can have some fun. The job of creating a story need not be a project for the individual, but may be a perfect task for groups. Computer user groups, school classes, party groups, and clubs of all kinds can make up adventures.

The group leader or teacher could write a story introduction and present it to the others. This introduction leads to some sort of choice of action. The group then splits in two, with each subgroup working together on one of the branches of the story. When each subgroup has completed one story segment, it should split again to pursue each new sub-branch. This splitting and writing process should continue until each individual in the group has written a unique story ending.

"Computer user groups, school classes, party groups, and clubs of all kinds can make up adventures."

In most groups an entire adventure can be created in less than forty-five minutes. In this writing method, no one knows very much of the total adventure, so all participants can enjoy the twists and turns of plot.

Extending The Concepts

With the program and ideas presented here, participants in the Home Computer Revolution can enjoy the excitement of creating a new form with the computer. In addition, these concepts will provide a springboard for more refined methods of generating stories. Perhaps someone who has never written a story will experience the joy of seeing a new story take shape. In all these possibilities, computer explorers will be learning more about what makes their computers "click."

Desert Dilemma
Explanation of the Program

Line Nos.	
100-150	Program header.
160-180	Initialize.
190-210	Story beginning subroutine.
220-310	Listen and test reader input.
320-380	Reads and prints each story segment.
390	To story ending subroutine.
400-410	Reads input.
420-450	Error subroutine.
460-500	Story ending subroutine.
510-540	Begin again.
550-1310	Data statements for the story.
1320	End.

```
100 REM  ********************
110 REM  *  DO IT YOURSELF  *
120 REM  *    ADVENTURE     *
130 REM  ********************
140 REM  BY JAMES SCHWARTZ
150 REM  99ER VERSION 2.12.1
160 REM  =>INITIALIZE
170 DIM USED$(20)
180 X=1
190 REM   =>STORY BEGINNING
200 CALL CLEAR
210 GOSUB 550
220 REM =>LISTEN AND TEST
230 INPUT "":A$
240 FOR I=1 TO X
250 IF A$=USED$(I)THEN 420
260 NEXT I
270 READ B$
280 IF A$=B$ THEN 310
290 IF B$="ERR" THEN 420
300 GOTO 270
310 USED$(X)=A$
320 CALL CLEAR
330 X=X+1
340 READ C$
350 IF C$="OOO" THEN 380
360 PRINT C$
370 GOTO 340
380 READ D$
390 IF D$="XXX" THEN 460
400 RESTORE
410 GOTO 230
420 REM  =>ERROR
430 PRINT "SOMETHING IS WRONG.T
    RY AGAIN"
440 RESTORE
450 GOTO 230
460 REM  =>ENDING
470 PRINT
480 INPUT "TRY AGAIN?":X$
490 IF X$<>"Y" THEN 1320
500 RESTORE
510 FOR I=1 TO X
520 USED$(I)=" "
530 NEXT I
540 GOTO 160
550 REM  =>FIRST SCREEN
560 PRINT "******************"
570 PRINT "* DESERT DILEMMA *"
580 PRINT "******************"
590 PRINT ::::
600 PRINT "ZAHRAH HAS JUST RETU
    RNED":"FROM A MORNING AT TH
    E WELL.":"SHE HAS BEEN TELL
    ING YOU":" ABOUT A CONVER-"
```

Continued on p. 48

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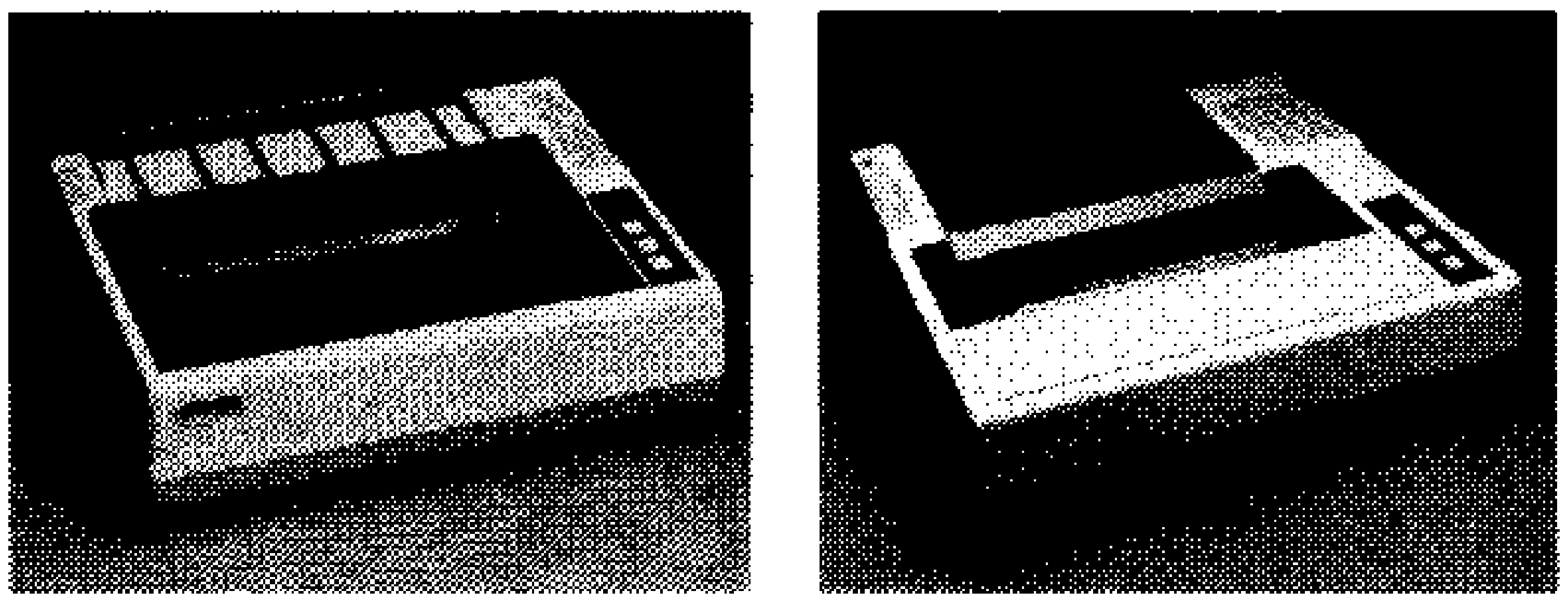

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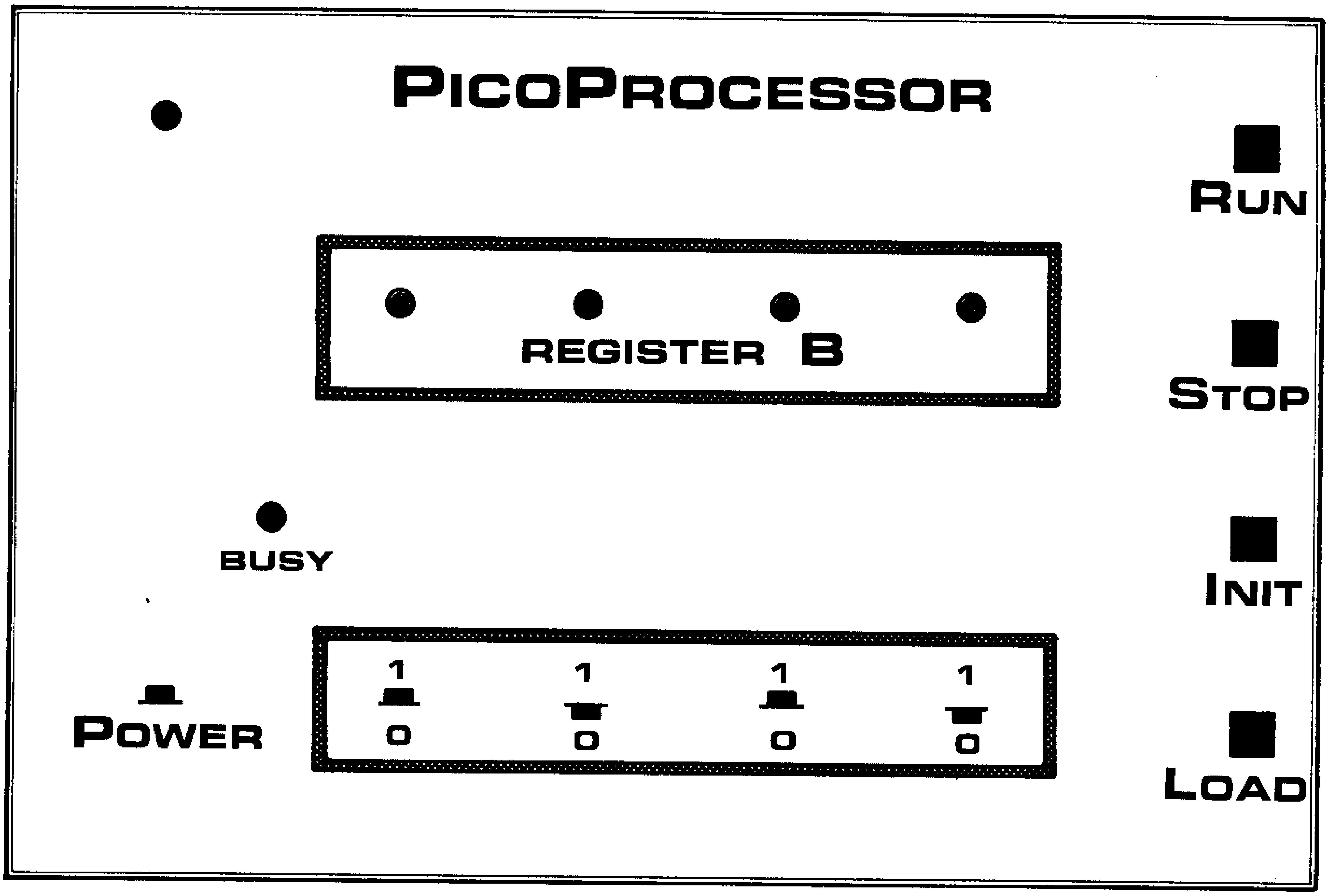

A 4-Bit Micro Emulator

by Michael W. Hill
403 4th Avenue
Opelika, AL 36801

If you're like most 99/4A owners, you've heard about the powers of machine language and assembly language programming: awesome speed, dazzling high-resolution graphics, and ultimate flexibility. But you may hesitate to try machine/assembly language programming because of the extra costs of equipping the 99/4A (minimum requirement: the Mini Memory Command Cartridge). Besides, it looks pretty complicated, and the instructional material you've seen seems geared to the budding computer scientist.

Take heart! For just the the time it takes to type in *Microemulator*, the BASIC program listed here, your 99/4A *can* run machine language programs. No modules, expansion boxes, or floppy disks required!

We'll find our way by studying a simplified hypothetical computer called Picoprocessor.* It is patterned after the Altair 8080, the hobbyist's state-of-the-art machine only a few years ago, and still found in university computer science departments. The model we put up on the screen will help us to see how machine language and assembly language work, and how they're related. We'll become familiar with basic terms and concepts associated with machine/assembly programming. And we'll use machine language instructions to write simple programs. *Microemulator* won't make you an expert in 9900 Assembly Language, of course, but it will give you the confidence to tackle TI's Editor-Assembler Manual and more advanced Super Language articles in *99'er HCM*.

Picoprocessor is a 4-bit, bus-oriented system. It has two *registers* named A and B (which are 4-digit binary counters) and a *program counter* (also a 4-digit binary counter) which addresses the program memory (RAM). The program counter can hold any one of 16 different numbers, so it can address 16 memory locations. Remember we said Picoprocessor was a 4-bit machine? This means its CPU can handle binary numbers that are four digits long (e.g., 1011). Accordingly, its program memory can hold one four-digit (4-bit) binary number at each memory location. So there are four bits of memory at each of 16 memory locations (also called *addresses*). Because a four-bit binary number is called a *nybble*, Picoprocessor is said to have a 16-nybble memory. Two nybbles equal one *byte*, so we can also say Picoprocessor has 8 bytes of RAM. This is 1/2048th of the RAM in your 99/4A!

Table 1

Binary	Decimal	Hexadecimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

**Picoprocessor is similar in function to an imaginary computer, called PIP-2, outlined by Forrest M. Mims in the* 1981 Electronic Experimenter's Handbook *(Ziff-Davis). PIP-2 was a simplified version of PIP-1, another hypothetical machine described in* Understanding Digital Computers *(Texas Instruments Learning Center).*

Think of it—

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FOR READERS WHO DON'T YET HAVE A TI COMPUTER

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3. **What do you anticipate your primary use of a TI computer will be?** ☐Entertainment ☐Education ☐Computer literacy ☐Household management ☐Job-related homework ☐Business ☐Professional use

FOR PRESENT TEXAS INSTRUMENTS COMPUTER USERS

1. **Which system(s) do you currently own?** ☐99/4 ☐99/4A ☐CC-40
2. **What was your primary reason for buying it?** ☐Entertainment ☐Education ☐ Computer literacy ☐Household management ☐Job-related homework ☐Business ☐Professional use
3. **What was your primary reason for buying the Texas Instruments brand?** ☐Company name/reputation ☐Features for the money ☐16-bit microprocessor ☐Convinced by friends/relatives ☐Ease of use ☐Prior use in course or "Advantage Club"
4. **Which additional TI computer are you likely to purchase within the next 6 months?** ☐None ☐99/4A ☐CC-40
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6. **Put a CIRCLE around the above peripheral you are most likely to buy within the next 6 months.**
7. **Mark all TI language software you own or plan to buy within 6 months.** ☐Extended BASIC ☐99/4A Editor/Assembler ☐UCSD Pascal ☐LOGO ☐Forth ☐Mini Memory ☐Pilot ☐CC-40 Editor/Assembler
8. **How much money do you expect to spend within the next 12 months on your computer system?**

Software	☐None	☐less than $30	☐$30-50	☐$51-100	☐$101-250	☐over $250
Peripherals	☐None	☐less than $50	☐$50-100	☐$101-250	☐$251-500	☐over $500
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14. **On the average, about how many program listings in each issue do you key into your computer and use?** ☐None ☐1 ☐2 or 3 ☐4 or more

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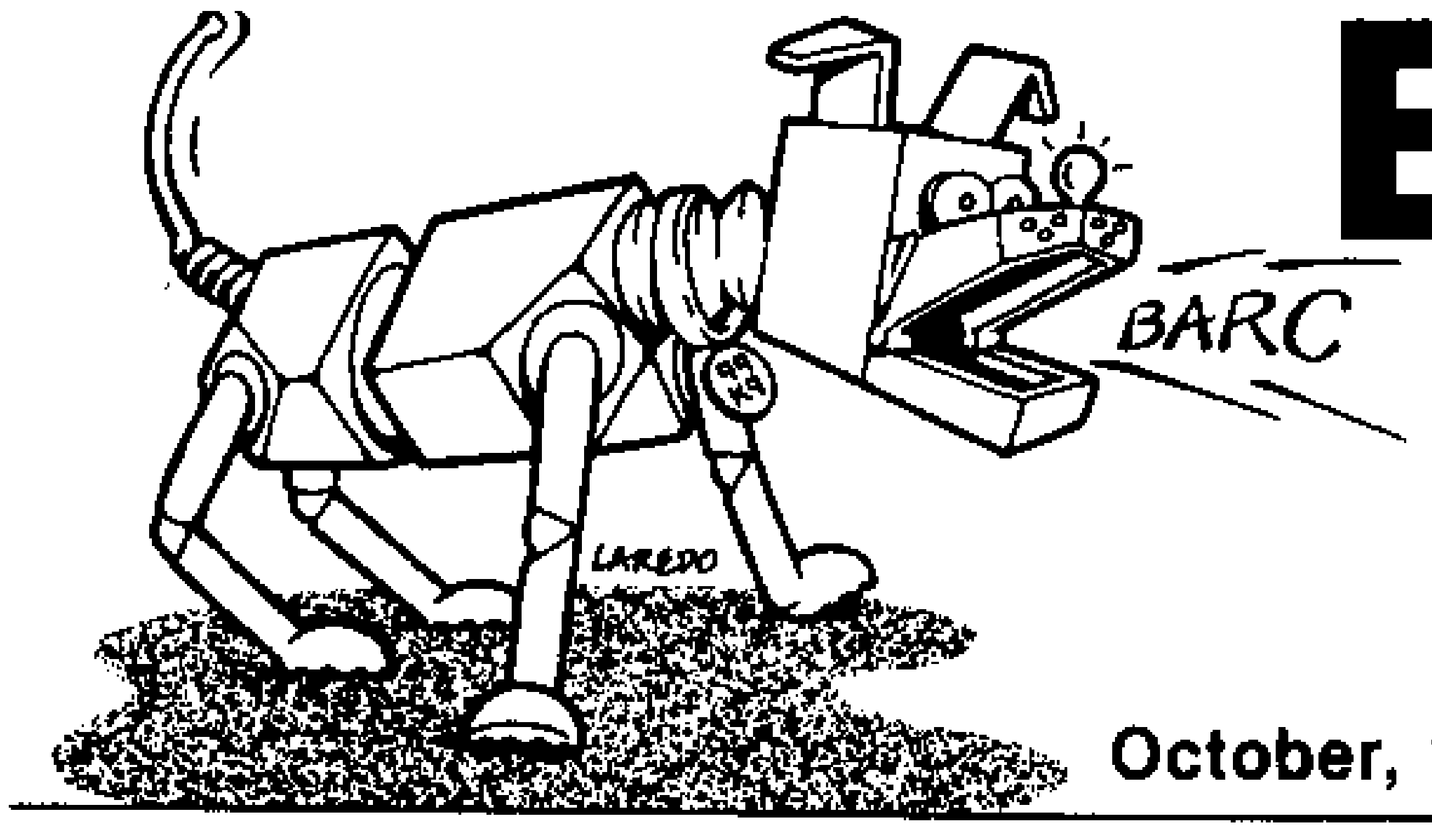

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October, 1983

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Glossary

Address: The number used to indicate a particular memory location. "To address" means to select a memory location in order to store, retrieve or manipulate its contents.

Assembler: A computer program which translates mnemonics into machine language opcodes.

Assembly Language: A language in which programs are entered into the computer as mnemonics and data, with each mnemonic and data item being associated with a particular memory location (as BASIC operations are associated with line numbers.) An assembler translates this listing into the equivalent machine language program, which can then be SAVEd and RUN.

Bit: A one-digit binary number (either 1 or 0.)

Bus: A group of parallel wires (or other conductors) used to carry information between various sections of the computer, in much the same way as a freeway permits people to drive side by side.

Byte: An eight-digit binary number; eight bits.

Chip: An integrated circuit (IC).

Counter: Electronic circuit which counts pulses of electricity and outputs the running total, often as a binary number. Some counters are pre-settable which means they can be used to store a binary number directly.

CPU: Central Processor Unit; the section of a computer which controls the processing of instructions, performs arithmetic, and coordinates the overall activities of the machine.

Crash: A condition in which a computer "locks up"—will not respond to its keyboard—and displays gibberish on its screen. This usually occurs because a faulty machine language program has been run. This is only a software problem, so it cannot harm the computer.

Emulator: A program which enables one computer to imitate or mimic a different type of machine.

Front Panel: An input/output device which uses hardware (switches, lights, logic circuits, etc.)—rather than a keyboard, video displays, and monitor software—for communication between operator and computer. While primitive, it allows very direct control over the machine.

IC: Integrated Circuit; one or more complex electronic circuits built on a tiny sliver or "chip" of silicon.

Instruction: A statement which tells the CPU to perform a specific operation.

Instruction Set: All the instructions which a CPU understands. Different types of microprocessor CPU's have different instruction sets.

LED: Light Emitting Diode; a solid-state component which glows when power is applied to it. There is a LED next to the on/off switch of your 99/4A. Bicolor LEDs can be made to glow in either of two colors.

Machine Language: The only language a computer understands directly. Machine language programs consist of binary numbers representing instructions and data, with each number being associated with a memory location.

Memory Location: Computer memories are divided into small chunks or locations. Each location may hold one number—a byte in the case of the 99/4. In order for us to be able to tell the computer where to store a particular number (or where to retrieve it from), each chunk or location is assigned a unique identifying number called its address.

Microprocessor: An IC which contains the essential parts of a simple CPU. Microcomputers are built around microprocessor CPU's, and often use other microprocessors to operate the display, generate sounds, etc.

Mnemonic: An alphanumeric "abbreviation" for a specific computer instruction. Mnemonics symbolize opcodes and are used by programmers because they're easier to remember than numbers.

Nybble: A four-digit binary number; four bits; half a byte.

Opcode: An Operation Code is a number which represents a particular instruction to the CPU.

Picoprocessor: A make-believe microcomputer. Not a very powerful machine, but you can't beat the price!

Program Counter: Circuit (often part of the microprocessor) which sequentially addresses memory locations to permit loading each program step in order. When a program is running, the program counter addresses each step in memory, in the proper order, for use by the CPU.

RAM: Random Access Memory consists of circuitry used to electrically store binary numbers, which can later be retrieved or changed. RAM contents are erased when power is removed.

Register: A circuit used to store a binary number temporarily; often part of the microprocessor.

Toggle Switch: Mechanical device like a common light switch. One toggle switch turns Picoprocessor on and off while others are used to enter programs and data.

We've talked a lot about binary numbers, so let's look at some. Don't worry, you won't have to do any high-powered math—just use Table 1.

Like the TMS9900 (which is the CPU in your 99/4A) and every other microprocessor, Picoprocessor's CPU understands only certain *instructions* built in by the people who manufacture it. All the instructions which a microprocessor understands make up its *instruction set*. Picoprocessor's instruction set is contained in Table 2.

The *opcodes* (short for operation codes) in Table 2 are what the CPU actually reads and understands; the *mnemonics* listed are just memory aids to help us human programmers! The machine reads the opcodes in their binary form, but people sometimes use the hexadecimal (Hex) form. Take a few minutes now to complete Table 2 by adding the hexadecimal opcodes (Use Table 1 to translate the binary opcodes). Finished? Now let's look at each instruction in more detail.

ADD adds the numbers in Registers A and B and stores the sum in Register A. One minor complication—both registers are 4-digit binary counters, so the biggest number either can hold is 15 (decimal) or 1111 (binary). If the sum of A and B is more than 15 (decimal), the register recycles. Example: 15 + 1 becomes 0 (or 1111 + 0001 becomes 0000). What would 10 + 10 (or 1010 + 1010) be? Think of a car's odometer which "rolls over" at 99,999.9.

HLT, stops the program and returns Picoprocessor to its "command mode." Always make HLT the last instruction in your program on Microemulator.

JMP tells the machine to "go to" the address listed in the nybble following it and continue executing the program from that point. Again, the number at the address following JMP is *not* an opcode, but instead a number representing *another address*.

LDA tells the machine to get the number at the next address and put it in Register A. Notice this means that the number at the address following the LDA is *not* an opcode—just a number.

Table 2

Mnemonic	Instruction	Opcode Binary	Hex
ADD	Add A and B; put sum in A	0010	____
HLT	Halt program execution	1111	____
JMP *address*	Jump	0100 *xxxx*	____
LDA *nybble*	Load A Register with next nybble	0001 *xxxx*	____
MOV	Move A to B; save A	1000	____
NOP	No operation	0011	____

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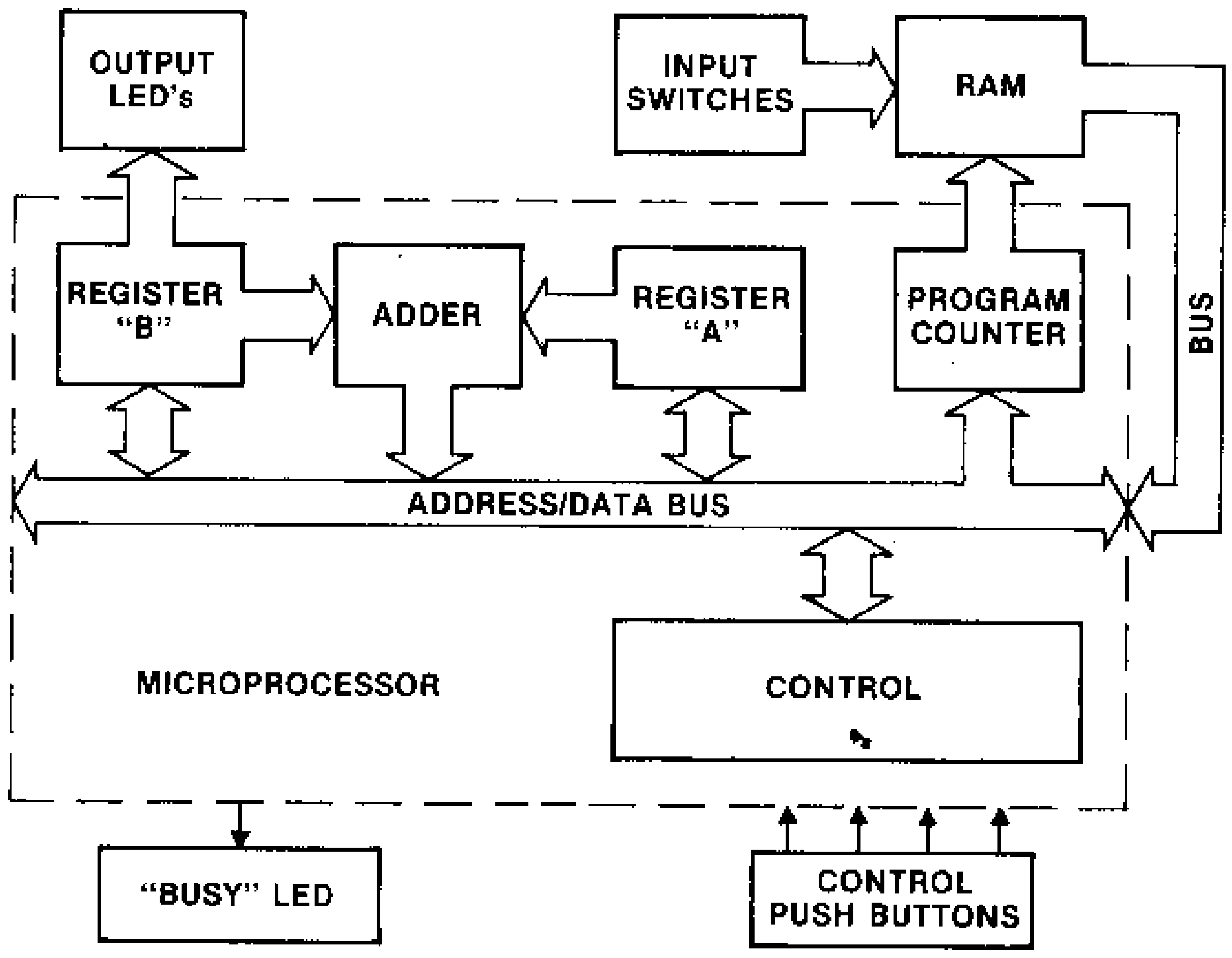
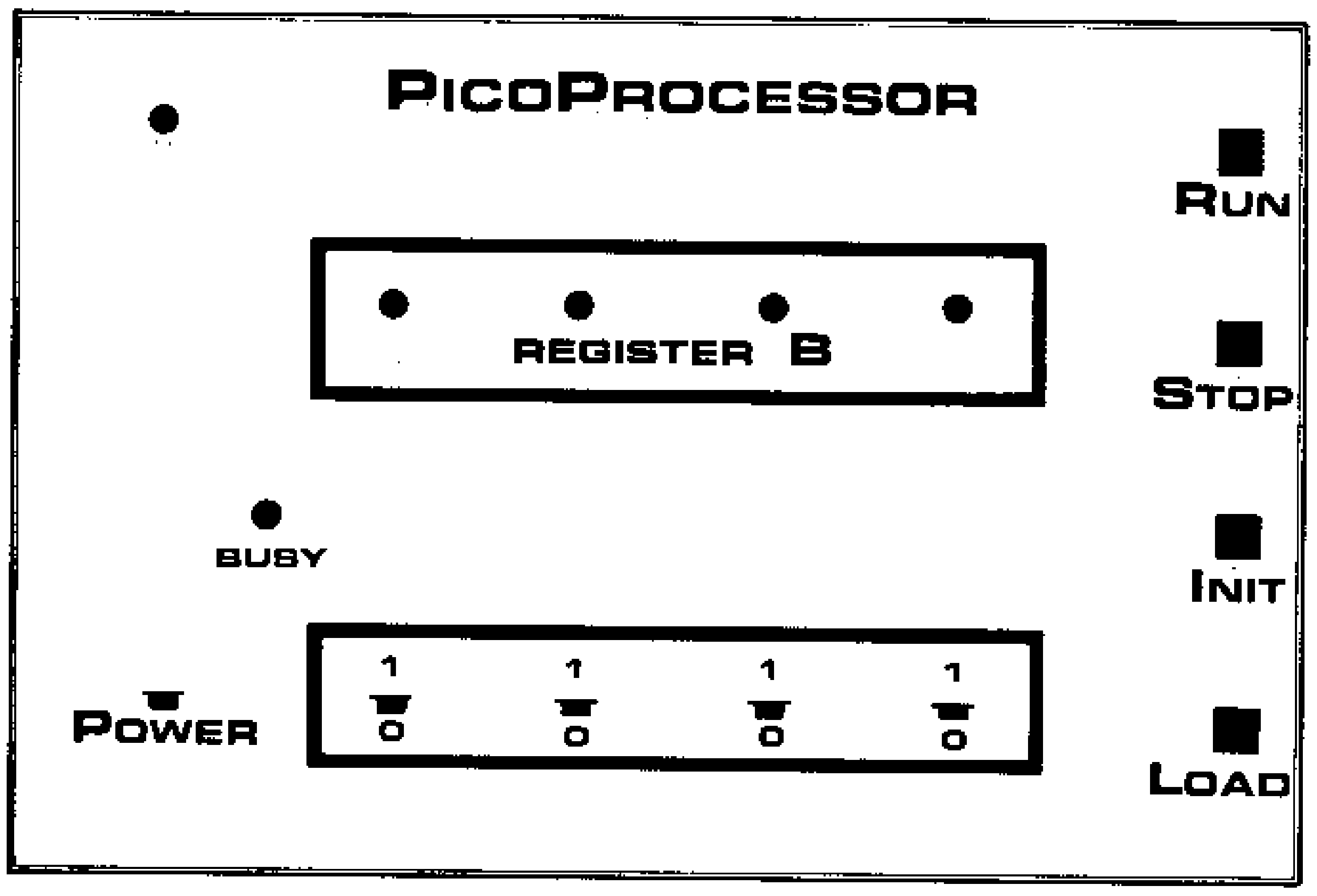


—SYSTEM DIAGRAM—
"Picoprocessor"



- **"Busy" and "Pilot" are black or red**
- **"Output" LEDs are black, green or red**
- **All switches are animated**
- **Switches shown in off or zero position**

MOV takes the number in Register A and moves it to Register B. The number *replaces* any number previously in B. (The number also stays in A, so A and B will be equal).

NOP means (to the CPU) "Don't do anything for one cycle." It can be used as a time delay, or to reserve a memory location (address) so we can go back later and insert another instruction in our program.

Assuming you've already typed in, debugged, and SAVEd *Microemulator*, load it into your 99/4A via BASIC's OLD command and RUN it. After the title screen, you will be asked if you want a listing file (or *protocol*) of Picoprocessor's run. If you answer Y, you will then be asked for the device parameters: either printer parameters or a disk filename are permissible. (If you change line 2410 to read OPEN #1:PT$,OUTPUT,FIXED, you can use a cassette recorder instead. Be sure to leave your cassette recorder on RECORD until the end of the program. In this case, alter line 130 in Listing 2 as well, to read OPEN #1: IN$,INPUT,FIXED to read the file from cassette.) Next you will see Picoprocessor's *front panel* on your TV/monitor. In the upper left corner is Picoprocessor's pilot light (a red LED). Well, of course it's dark—the power's off! The power switch is in the lower left corner. Turn it on now by pressing the P key. (Don't hold it down). The four LEDs which just turned dark green are bicolor LEDs which show the contents of Register B. They make up Picoprocessor's *Register B*. Green represents 0; red represents 1. The toggle switches directly below them are Picoprocessor's *input* devices. Down represents 0, and up means 1. These switches are operated by keys 1, 2, 3, and 4—each press tog-

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gles them from down to up, or vice-versa. Try manipulating them until you get the feel of it.

The push buttons on the right side of the panel are operated (from bottom to top) by keys L, I, S, R. The **Load** button loads the number on the input switches into the memory and then automatically increments the program counter to the next address. **Init** returns the program counter to address 0000 and also clears the registers A and B, or sets them to 0. **Stop** stops any program executing and **Run** starts program execution. Try out the push buttons.

Picoprocessor seemed to go crazy when you pushed **Run**, didn't it? Notice that the **Stop** button will not stop it! This condition is called a *crash*, and it happened because we didn't have a valid program loaded. To get out of the crash, we must turn off the power (the make-believe power!) and turn it back on. There—all back to normal. Note that the crash—which sounds like a catastrophe—didn't hurt Picoprocessor in the least. This is important because real machine language programs on real-life computers also crash! It doesn't hurt them either, and the "fix" is the same—power off and on. (Some machines have a reset which allows recovery from a crash without a power-down.) You do lose your program from memory when you recover from a crash. On real computers one learns to SAVE one's new programs before one runs them the first time!

You can exit the *Microemulator* program by turning off Picoprocessor's power and pressing the E key. Let's do that to rest the monitor while we write a program for Picoprocessor!

Table 3

Address	Mnemonics/ Data	Binary Opcode/ Data
0000	LDA	________
0001	0001	________
0010	ADD	________
0011	MOV	________
0100	JMP	________
0101	0000	________
0110	HLT	________

The addresses look like line numbers in BASIC, don't they? The first instruction loads the A register with the number at address 0001, which happens in this case to be 0001. The next step adds A (or 0001) and the contents of register B (which is now 0000) and puts the sum (0001 this time) in A. Next, the number in A is moved to B, so B is 0001 (this time around). Finally, the program jumps (or loops) to the address listed at address 0101, which is 0000—and the whole cycle starts over. What will happen in the second cycle? The third? What will Picoprocessor's Register B LEDs show?

Before we can load our program into Picoprocessor's memory, we must translate the mnemonics, in which we wrote the program, into binary opcodes. Do that now, using Table 2, and write the opcodes in the blanks provided.

Toggle It In

Ready? Then RUN the *Microemulator* program again and we'll load the machine language program and see what happens! First, turn Picoprocessor on. Then press **Init** to set the program counter to address 0000. Now set the first opcode on the input toggle switches and press **Load**. The program counter (PC) automatically advances to address 0001. (We can't see it, although Picoprocessor's listing will record the PC and the contents of that memory location on every Load operation if you selected the listing feature.) Set the second opcode (or data number or JMP address) on your toggle switches, press **Load**, and continue likewise until you've loaded the whole program. Now press **Init** to return the PC to address 0000. And cross your fingers while you push **Run**! (If you get a crash, just power off and on and recheck your work). Was the result what you expected?

If you have a printer, and want a listing, you get a step-by-step record—or protocol—of the operation of the Picoprocessor program. The protocol will first list PC and the contents of that address as you Loaded it. After the marker ********** RUNNING, it will list the location of the PC, the instruction (or opcode) at that location, and the contents of registers A and B *before* that instruction is executed. If you have a disk system, you can also specify disk for the listing. Listing 2 will read the file from disk and print it on your printer. To print to the screen, delete lines 120 and 140 and alter line 170 to read PRINT A$. Creating a listing slows the program's operation down a bit. It runs fastest of all when it doesn't have to produce a listing—but then it's also hardest to understand the program's operation.

After you understand what the first program did, try writing Pico-programs to do the following things.

—count by two's (i.e., 0-2-4-8-etc.)
—count by three's
—add two numbers and stop
—double a number (e.g., 2-4, 3-6, etc.)
—flash the LEDs in sequence from right to left
—flash the LEDs simultaneously

Can you think of other programs which can be written and run on Pico?

Summing it Up

Obviously Picoprocessor is limited in the programs it can run. Any of the programs we mentioned can also be implemented in hardware—with simple digital logic IC's. However, doing so on a breadboard,would take literally hours, whereas we can do it in Pico-software in minutes! This is the great power of microprocessors and microcomputers.

Machine-language programs for real computers like your 99/4A are very similar to the Pico-software we've just written.

"Machine-language programs for real computers like the 99/4A are very similar to the Pico-software."

Of course, the 99/4A has a larger instruction set and a more complex architecture, (more registers, more input/output devices, etc.) for the CPU to address. In addition, practical machine language programs for the 99/4A will usually be longer than our Pico-programs. . . perhaps a hundred or more "lines." And since the 99/4A is a sixteen-bit computer, its opcodes will be *sixteen* binary digits each instead of four digits. The address numbers will be larger as well, since the 99/4A has more memory (!) than Picoprocessor. Now, having more instructions to work with won't make programming on the 99/4A any harder than it was on Picoprocessor—we'll simply have to learn the extra instructions a few at a time, just as we learned BASIC commands. The same goes for the more complicated architecture.

The prospect of translating (assembling) hundreds of mnemonics into hundreds of sixteen-digit binary numbers, however, is appalling! (Not to mention typing each of those binary numbers into the console.) Besides the tedium, mistakes are all but inevitable. Could we have the machine do the tedious, repetitious work for us? You bet! A type of program called, logically enough, an *assembler* will allow us to simply type in the addresses (often in hexadecimal form) and the mnemonics (in alphanumeric form) and proceed to run our program. Nice! Assemblers, which may be written in a high-level language like BASIC or may be in machine language themselves, often have additional features to facilitate debugging, modifying, and SAVE-ing your programs. When people talk about assembly language programs, they are referring to programs which were written using an assembler program.

You can buy assembler programs written in BASIC for your 99/4A. [*99'er HCM* reviewed two of them in August; see "An Ensemble of Assemblers." Both use the Mini Memory cartridge.—Ed.] In addition, the Mini Memory cartridge comes with a Line-By-Line Assembler written in 9900 Assembly Language. The Editor/Assembler Command Cartridge, which requires the 32K memory expansion, also will permit you to program in Assembly Language. But before you take the plunge with those relatively complex systems, you might want to spend a few hours with *Picoprocessor,* getting the feel of assembly language programming.

Continued on p. 50

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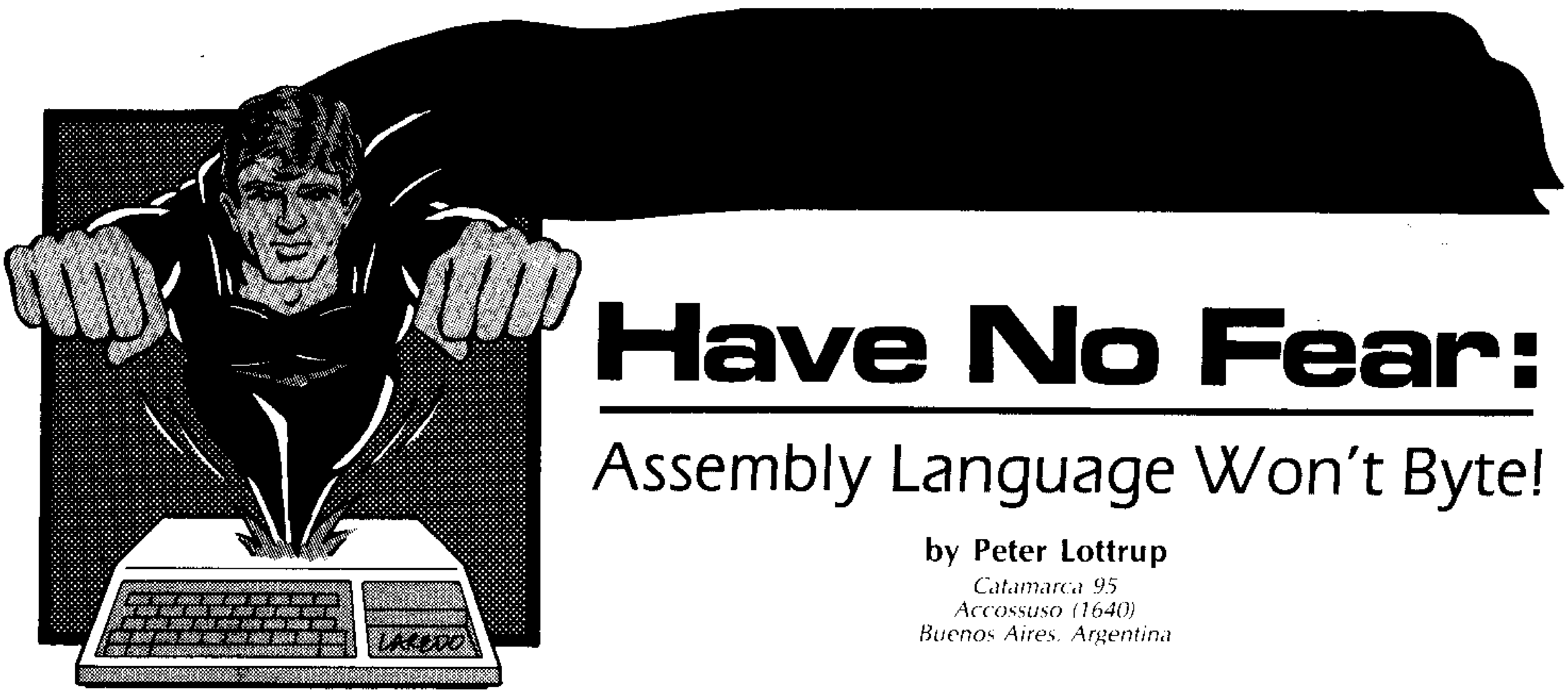

Have No Fear:

Assembly Language Won't Byte!

by Peter Lottrup

Catamarca 95
Accossuso (1640)
Buenos Aires, Argentina

When playing space games, you may boldly battle terrifying creatures hurtling from your screen, but when you come up against that beast called Assembly Language, your first response might be to run and hide. Even the stoutest of hearts can turn to jello at the mere mention of that dread idiom. But before we start on this adventure, let me assure you: Assembly Language does not bite!

This article is aimed at those of you who own the Mini Memory Command Cartridge with the *Line-by-Line Assembler* on cassette. This package lets you begin in Assembly Language, without having to buy the expensive equipment necessary for the Editor/Assembler cartridge. When I decided to outfit myself this way, and bought the Mini Memory cartridge, I faced the same problems encountered by all newcomers to Assembly Language. When I got home with this software package and opened the manual, the first things that caught my eye were: ". . . it is assumed that you are experienced in TMS9900 assembly language programming. . ." and ". . . see the *Editor/Assembler* owner's manual." As I was already home with empty pockets, I decided to go ahead without the help of that manual, still believing that most of the information would be found, though greatly condensed, in the Mini Memory manuals.

But Assembly Language was totally different from BASIC, and the manuals didn't answer all my questions by any means. So I learned by trial, error and experimentation. As questions came to mind, I jotted them down, and now that I have answered those questions for myself, I can use my notes to cover most of the problems a beginner may have with Assembly Language.

Since I used these notes with success in teaching out of my home, I decided to adapt my findings into a short series of articles, so that readers will lose their fear of Assembly Language once and for all. This article will cover the structure of an Assembly Language statement, and treat some of the assembler directives. Future articles will deal with memory organization, the Symbol Table, and the Assembly Language instruction set with short explanations and examples. We will then move on to more complex Assembly Language programs, and saving and recalling programs by name. The series will cover, in general, the basics of Assembly Language programming.

When I began my trials with the Mini Memory cartridge, I decided to start out with the *Line-by-Line Assembler*. I got the initial menu screen and chose option 2, EASY BUG. Using EASY BUG's L command, which loads a program into Mini Memory from cassette, I loaded the assembler. After pressing [FCTN] [=] (QUIT), I selected option 2, RUN, and typed NEW. After reading the manual a little further, I tried typing in a line. But two seconds later, a mysterious ERROR message popped up. I tried again and again, but always got the same result. I looked through the small assembler manual, but it did not help much, so I packed away the cartridge. But that evening found me working on the computer again, and though I got ERROR messages quite often, I did not give up. The first thing I had to discover was how an Assembly Language statement is put together.

The Assembly Language on the TI-99/4A has four sections, or *fields*, in each statement. The first field is for an alphanumeric *label*, the second is for an *instruction* or an *assembler directive*, the third is for *operands*, and the fourth is for *comments*. These fields all appear on one line, and are separated merely by a space.

Using Labels

Rather than line numbers, as in BASIC, Assembly Language uses alphanumeric labels. With the *Line-by-line Assembler*, the labels can be one or two characters long, for example "G" or "AD." Labels are used so that you can identify a specific line. For example, if you want to display some TEXT which you have written in some other line, you must be able to identify the line so the computer can then find the text to be displayed. In BASIC, this is done with the line number, but in Assembly you do it with the label. It is obvious that only certain lines need labels. This provides more flexiblity when writing programs because you don't have to know exactly where a future line will be, but only what you want to call it. If you do not need one, just press the space bar once and the cursor will jump over into the next section of the line.

When you begin in the *Line-by-Line Assembler*, the screen will display two *hexadecimal numbers*, separated by a space, and followed by a flashing cursor, again separated by a space, as follows:

```
7D00 045B (Cursor here)
```

The first number specifies the *memory location* or *address* you're going to fill; the second is the present *contents* of that memory location. What you do with the Assembler is specify the new contents for that location.

One or two more things should be mentioned before we go on: If you type something wrong in the line, press [FCTN] [3] to clear the whole line and begin again. If you make a mistake with the label, just type the correct label right after it. The computer considers just the last two characters to be correct. For example if you type:

```
7D00 045B ASQS TEXT "HELLO THERE!"
```

The computer considers the label of the text to be QS.

The Instruction Field

In this field, you write the instruction, also called an *opcode*, to the assembler. It can be an assembler directive—more on these later—or it can be a normal instruction. To exit this section, you press the space bar. This field *must* be included. When you press the space bar again, you will enter the OPERAND field. The operands are what you are working with—numbers,

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for example—and they are included if the instruction in the opcode field needs them. See this example:

```
7D00 045B JA MOV R6,R9
```

In the example, JA is the label, MOV is an instruction in the opcode field, and R6 and R9 are the operands in the operand field.

The Comment Field

When you press the space bar again, you will enter the comment field. In this field you can write any remark about the line. (It's just like a tail remark in BASIC). Try it out by typing the following:

```
7D00 045B ST TEST "HELLO" HERE STARTS THE TEST
PROGRAM
```

Whatever you write in this field has no effect on the program itself. It serves mainly as your own guide.

AORG (Absolute Origin)

This instruction simply tells the assembler where you want to start your program, or which memory location you wish to be in. When you select the *Line-by-line Assember*, you will see:

```
7D00 045B
```

The "7D00" is the memory location you are working in. For the time being, just consider it a line number. Do not worry about the next number; it is only an instruction, written in hexadecimal, which was already in the computer's memory.

But now let's try out the AORG directive. First press the spacebar once and then type:

```
7D00 045B AORG >7DEA
```

And then press (ENTER). You see the following:

```
7D00 045B AORG >7DEA
7DEA 3903
```

Here's what has happened: When you typed AORG >7DEA, you told the computer where you wanted to "be" in hexadecimal (the greater-than symbol indicates a hexadecimal number). The computer then placed you at the correct spot to begin the new line. Note that you must type in a space between the directive AORG and the >7DEA. Otherwise you will get an ERROR message and will have to retype the entire line.

TEXT Directive

This is a simple instruction. It lets you write, enclosed in single quotes, what you would like to display on the screen. (It's like the DISPLAY AT in Extended BASIC). First press the space bar, and then write:

```
7DEA 3903 TEXT 'THIS IS A TEST'
```

And then press [ENTER]. You will see how the computer translates what you have written into hexadecimal as it fills the locations following >7DEA with the characters you've specified. Those locations and their new contents will be displayed on the screen, and the cursor will reappear at the first location following the text. Each character in the test is assigned its ASCII value: The T is 49, the H is 53, etc. That is all there is to it. Remember that you must type in a space between the directive TEXT and what is written in the quotes, or you will get an "ERROR" message. Also, unlike in BASIC, you must use single quotes.

Please note that this line displays only the ASCII codes, not the text on the screen; to display the text, another set of instructions is needed. We'll see this later on when writing our first test program.

END Directive

When you have finished, you end your program with the END directive and exit the assembler. To use the directive, type a space, write END and then press [ENTER]. Do not worry about what happens then, as we will learn about it when we start to write some programs.

In the next part of this series, we will learn what is behind the basics of programming in Assembly Language and start looking at Assembly Language statements. We'll then write a couple of short programs. But until next time don't be afraid to experiment.

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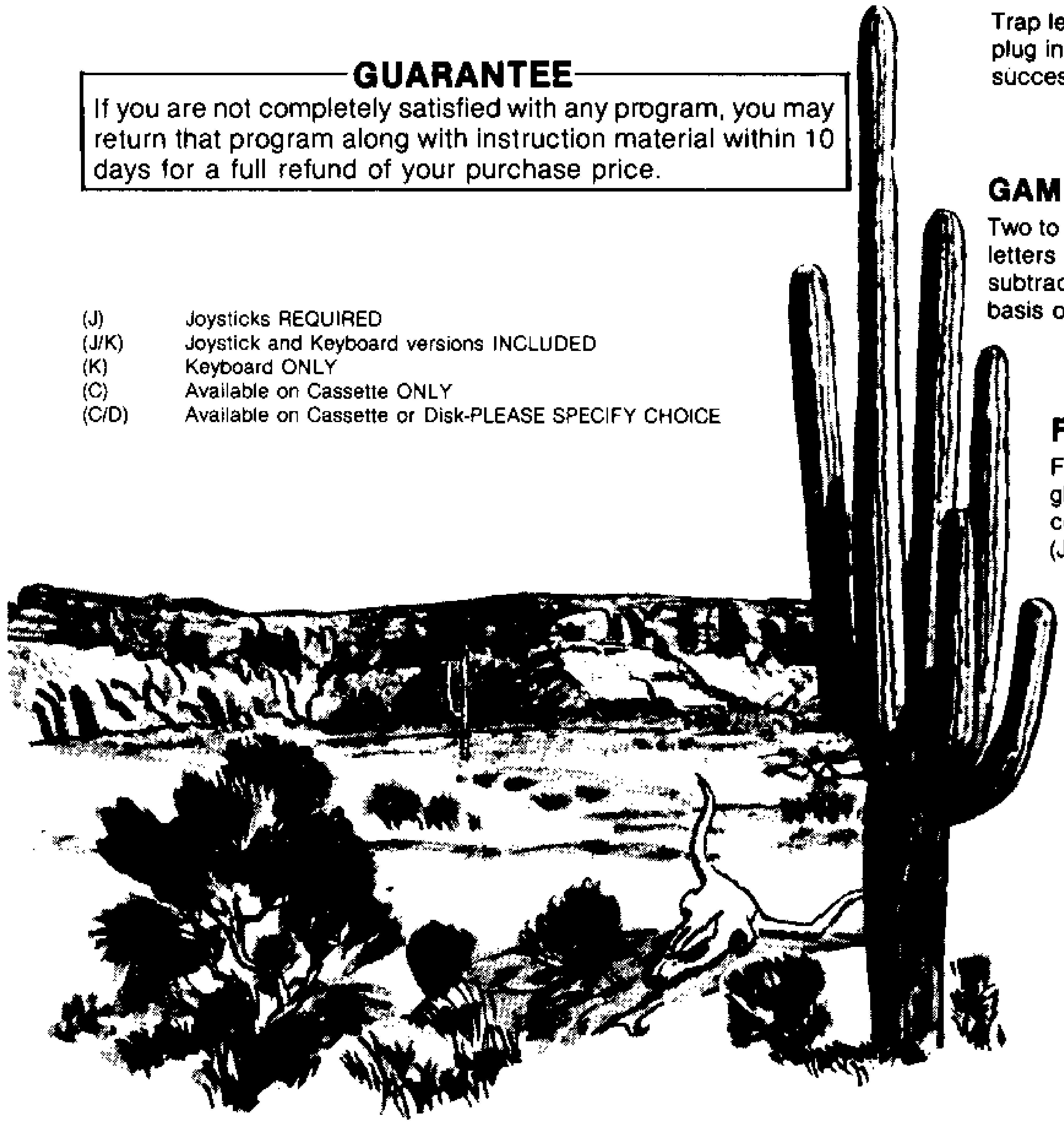

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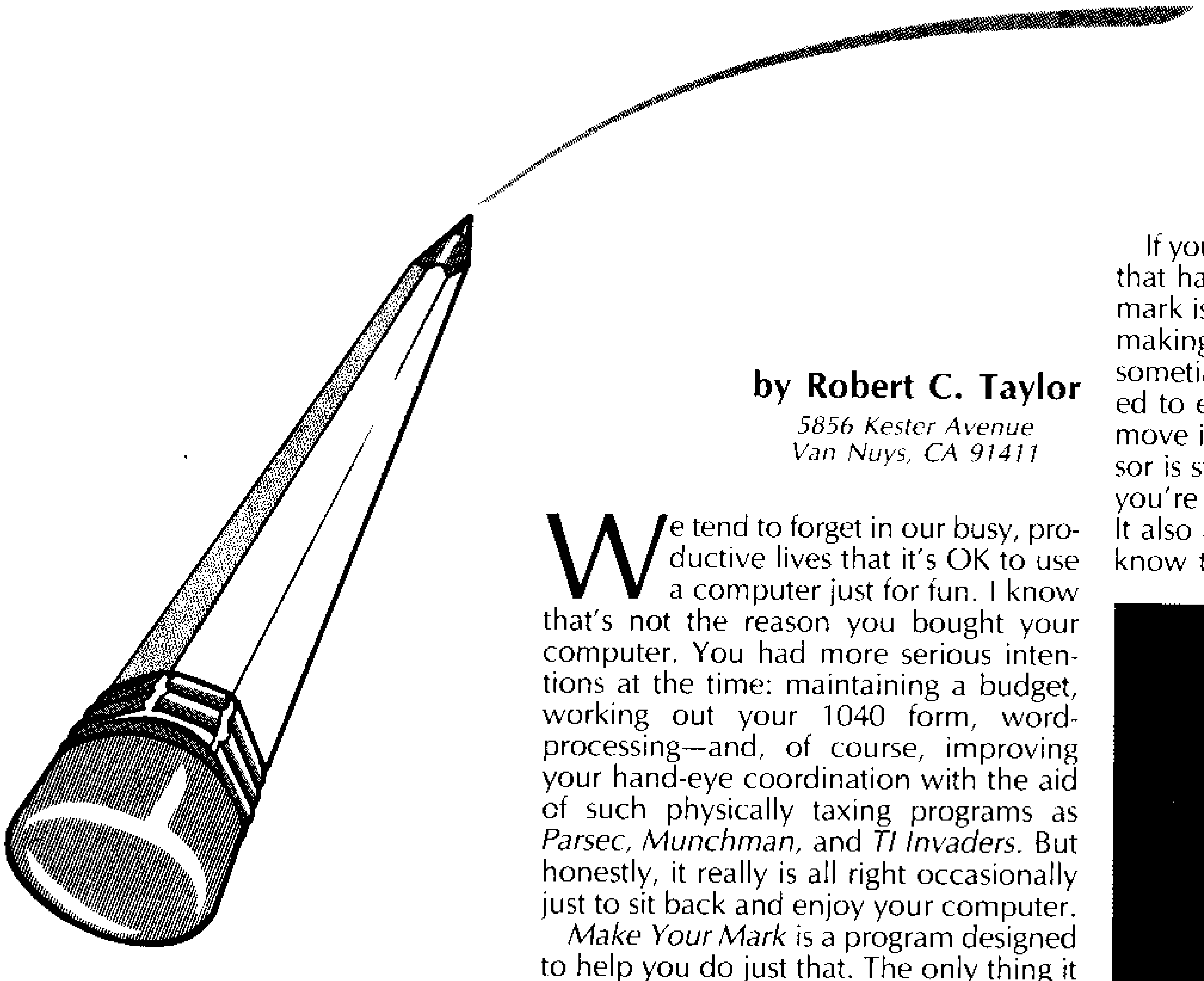


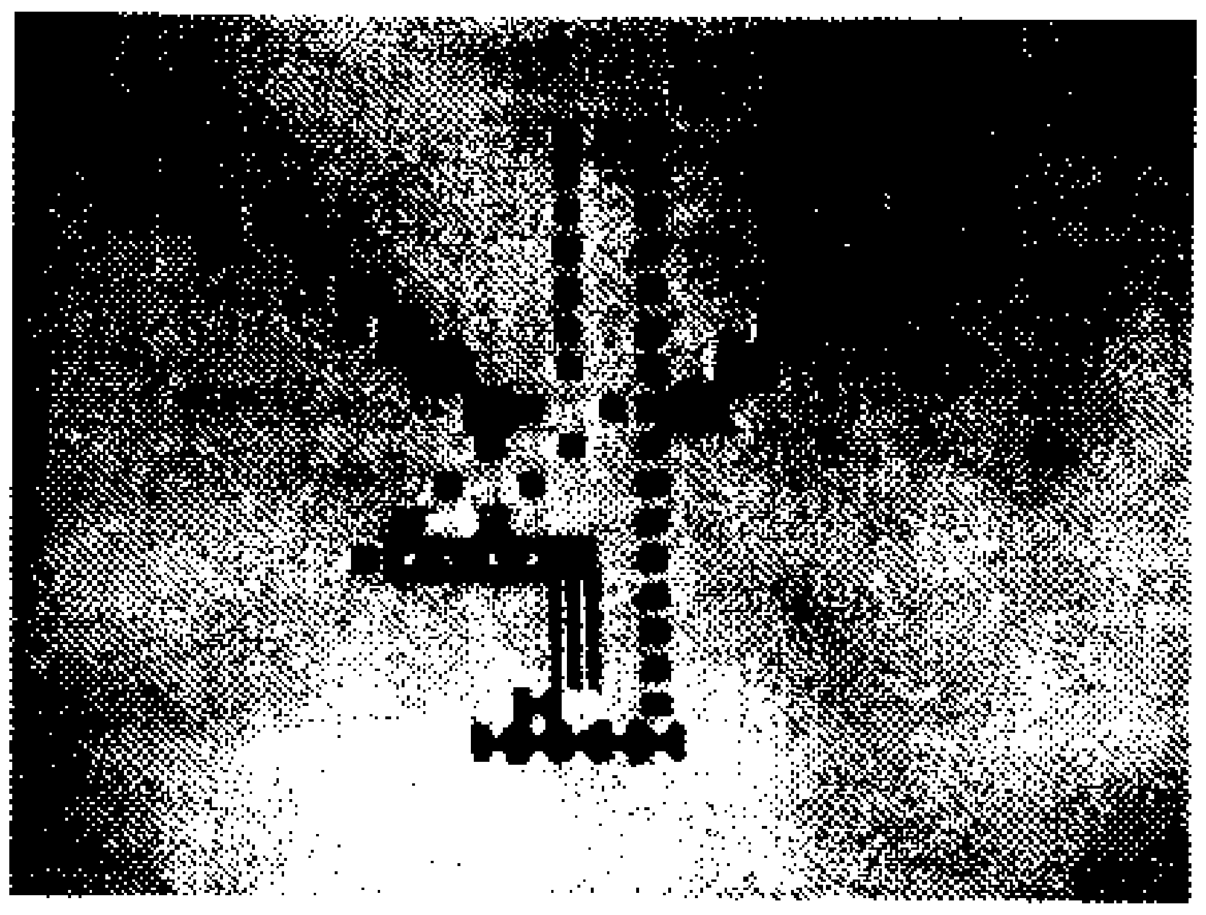
by Robert C. Taylor
5856 Kester Avenue
Van Nuys, CA 91411

We tend to forget in our busy, productive lives that it's OK to use a computer just for fun. I know that's not the reason you bought your computer. You had more serious intentions at the time: maintaining a budget, working out your 1040 form, word-processing—and, of course, improving your hand-eye coordination with the aid of such physically taxing programs as *Parsec, Munchman,* and *TI Invaders.* But honestly, it really is all right occasionally just to sit back and enjoy your computer.

Make Your Mark is a program designed to help you do just that. The only thing it is good for is doodling on your screen. You can enjoy it whether you're an engineer exhausted from number-crunching and looking for some mindless relaxation, or a three-year-old involved in the difficult, exciting process of learning to manipulate the world around you.

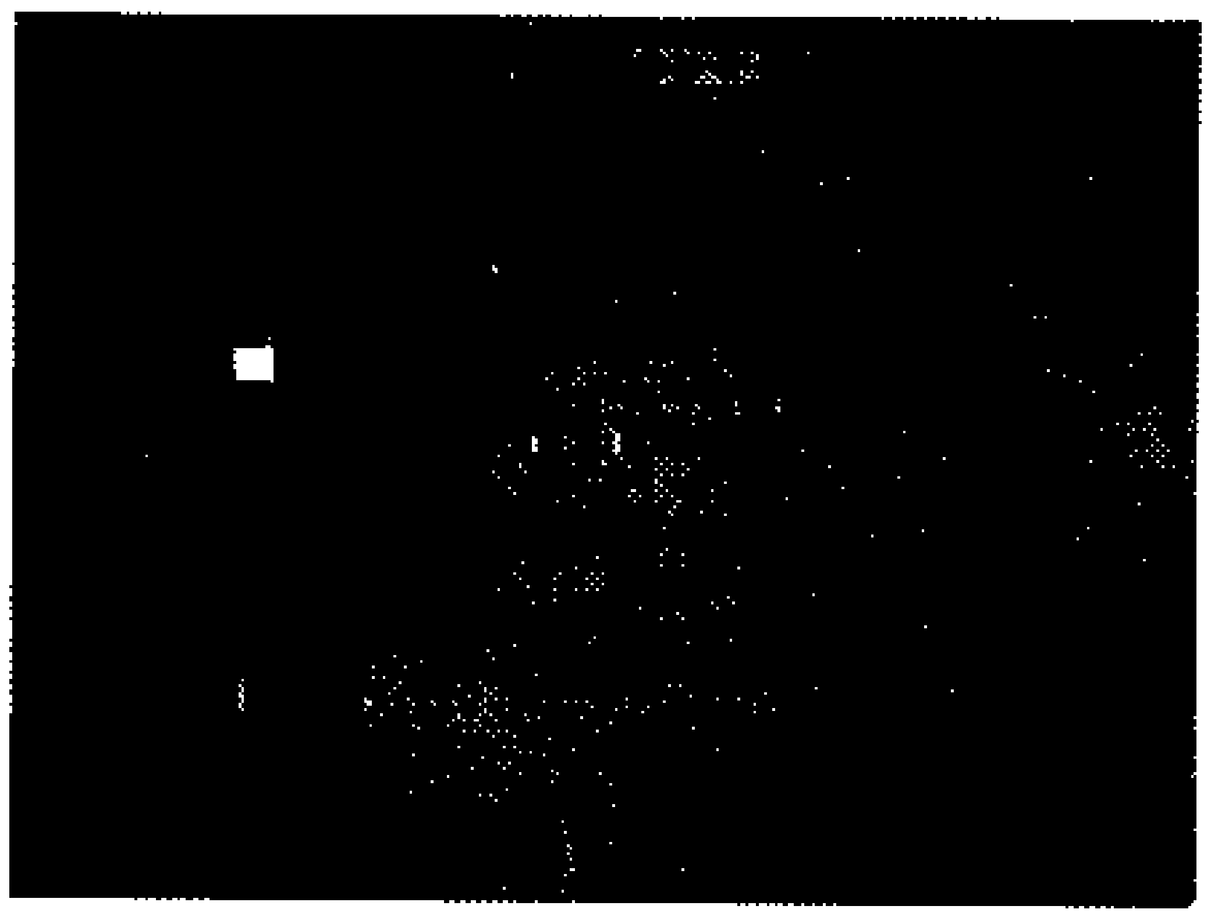
Overview

The instructions included in the program are quite complete, so I'll just briefly introduce the program here.



A flashing cursor is your pen point. It's placed on a blank screen, and you are free to move it using the joysticks or the keyboard. As it moves, it leaves behind a mark. You control the shapes and colors from the keyboard. There are eight predefined shapes and fifteen colors. You also control the color of the screen and may change it at any time.

If you move across an area of the screen that has already been drawn on, the old mark is replaced by the mark that you're making at the time. This can be a bother sometimes, so an option has been provided to enable you to "lift" your pen and move it without leaving a mark. The cursor is still there, so that you know where you're going, but it doesn't leave a mark. It also assumes a different shape, so you know that your pen has been lifted.



The pen is confined to an area that lies within the bounds of Graphics Rows 1 to 24 and Graphics Columns 3 to 30. It would be possible to have the pen "wrap" the screen, but there is nothing more annoying than doing that accidentally and discovering that you've destroyed a perfectly good design. An earlier version of this program allowed that to happen, and I know whereof I speak. This version has boundary restrictions. Those of you who don't like this restriction, take a look at the list of suggested modifications at the end of the article.

There may be a few times when you need an eraser, so the pen is equipped with one. When you choose the eraser option, the shape of the cursor again changes. Now, wherever the pen moves, it leaves behind a trail of blank spaces. There is also an "erase all" feature. Choose it, and the entire screen is wiped clean for you.

If you get distracted by the blinking cursor while you're trying to view your artwork, the push of a button makes the cursor vanish completely. Another push, and it's back again for more drawing.

After the completion of the instruction sequence, there are no prompts because almost every available character is redefined to provide a simultaneous display of up to eight different shapes in fifteen different colors. However, this

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shouldn't be much of a problem. The placement of the controls is easy enough to remember, and after a little experimentation you should have the hang of it.

Problems

Some people just can't sit back and have fun. They need to make work out of everything. So for you, and also for those who want to improve their programming skills, here are some suggested modifications. There are quite a few remarks in the program, so the logic should be easy to follow, and the routines and variables you need to be concerned with are clearly indicated. Try your hand at some of these:

1) Let the pen move freely past the edges of the screen and reappear on the other side.
2) Same as 1, except the pen can do this only in the "up" position.
3) Same as 1, except the pen is automatically placed in the "up" position.
4) Let the user define his own control keys.
5) Let the user define his own pen shapes.
6) Let the user save a screen on tape or disk and play it back at some future date.
7) Let the user see a screen of prompts reminding him of what the program control keys are, without losing the screen he was drawing.
8)Think of your own modifications.

Remember: it really is OK to have fun with your computer. Now, put the program in and Make Your Mark.

Make Your Mark
Explanation of the Program

Line Nos.	
100-170	Remarks and Header.
180-1010	Initialize variables, characters, and colors.
1020-1190	Mainline—scan keyboard for command.
1200-1410	Move pen.
1420-1500	Transfer control to proper command routine.
1510-1660	Lift or lower pen.
1670-1850	Erase or draw.
1860-1940	Cursor—visible or invisible.
1950-2010	Erase screen.
2020-2090	Change screen color.
2100-2190	Change pen color.
2200-2290	Change pen shape.
2300-3400	Print instructions and choose input option.

```
100 REM  ******************
110 REM  *  MAKE YOUR MARK  *
120 REM  ******************
130 REM  BY ROBERT C. TAYLOR
140 REM  99ER VERSION 2.12.1
150 REM  SET UP AND DATA
 INITIALIZATION
160 REM
170 REM
180 OPTION BASE 1
190 DIM A$(8),COM(7),CHR(16),DI
R(8,3)
200 DATA 69,0,-1,88,0,1,68,1,0
210 DATA 83,-1,0,82,1,-1,90,-1,
1
220 DATA 67,1,1,87,-1,-1
230 FOR I=1 TO 8
240 FOR J=1 TO 3
250 REM  DIR(): DIRECTION CODES
 FOR THE ARROW KEYS
260 READ DIR(I,J)
270 NEXT J
280 NEXT I
290 DATA 49,50,51,13,46,44,32
300 REM  COM: ASCII #'S OF THE
COMMAND KEYS
310 FOR I=1 TO 7
320 READ COM(I)
330 NEXT I
340 K=32
350 REM  CHR(): STARTING #'S  O
F EACH CHARACTER SET
360 FOR I=2 TO 16
370 K=K+8
380 CHR(I)=K
390 NEXT I
400 REM  A$(): CHARACTER CODES
FOR EACH SHAPE
410 A$(1)="FFFFFFFFFFFFFFFF"
420 A$(2)="AA55AA55AA55AA55"
430 A$(3)="FF0000FFFF0000FF"
440 A$(4)="9999999999999999"
450 A$(5)="FFFFC3C3C3C3FFFF"
460 A$(6)="00003C3C3C3C"
470 A$(7)="FF7E3C18183C7EFF"
480 A$(8)="81C3E7FFFFE7C381"
490 REM  CURSOR SHAPES
500 B$="8142241818244281"
510 C$="7EBDDBE7E7DBBD7E"
```

Continued on p. 24

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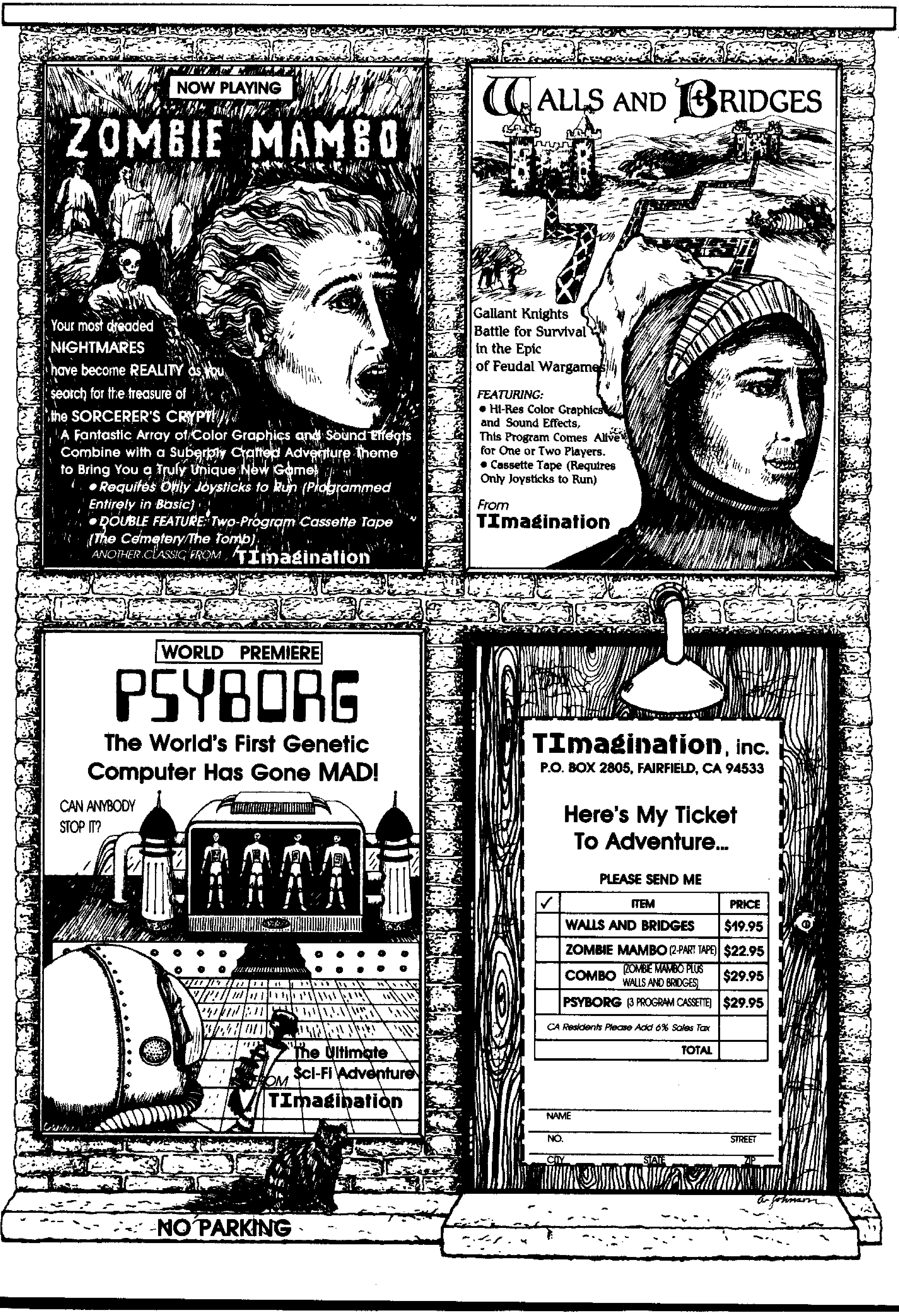
```
520 D$="00666666667E7E"
530 E$="FF9999999981 81FF"
540 F$="007E407C7C407E"
550 G$="FF81BF8383BF81FF"
560 REM  SET UP SHAPES FOR INST
    RUCTIONS
570 FOR I=1 TO 8
580 CALL CHAR(I+127,A$(I))
590 NEXT I
600 CALL CLEAR
610 REM  SET UP CURSORS
620 CALL CHAR(33,B$)
630 CALL CHAR(34,C$)
640 CALL CHAR(35,D$)
650 CALL CHAR(36,E$)
660 CALL CHAR(37,F$)
670 CALL CHAR(38,G$)
680 REM  GOTO INSTRUCTIONS
690 GOSUB 2330
700 REM  SET UP REMAINING CHARA
    CTER SHAPES
710 FOR I=39 TO 151 STEP 8
720 FOR J=1 TO 8
730 CALL CHAR(I+J,A$(J))
740 NEXT J
750 NEXT I
760 REM  SET UP COLORS
770 FOR I=2 TO 16
780 CALL COLOR(I,I,1)
790 NEXT I
800 REM  @SCREEN: THE SCREEN CO
    LOR
810 @SCREEN=16
820 REM   SET: THE CHARACTER SE
    T (2-16). CHARACTER: THE PA
    RTICULAR CHARACTER WITHIN T
    HAT SET.
830 REM  PUT: THE ASCII CODE FO
    R THE CHARACTER TO BE DSIPL
    AYED IN A CALL HCHAR STATEM
    ENT.
840 CALL COLOR(1,16,2)
850 SET=2
860 CHARACTER=1
870 PUT=CHR(SET)+CHARACTER-1
880 REM  ROW AND COL DEFINE THE
     POSITION OF THE CURSOR
890 ROW=12
900 COL=16
910 CALL SCREEN(@SCREEN)
920 REM  CURSOR: ASCII CODE FOR
     PRINTING A PARTICULAR CURS
    OR
930 CURSOR=33
940 REM  GOTO 'ERASE ALL' SUBRO
    UTINE
950 GOSUB 1980
960 REM  PRINT FIRST MARK AND S
    ET FLAGS. FLAG1: 1>PEN DOWN
    ; 0>PEN UP
970 REM  FLAG2: 1>MARK; 0>ERASE
    . FLAG3: 1>CURSOR; 2>NO CU
    RSOR.
980 CALL HCHAR(ROW,COL,PUT)
990 FLAG1=1
1000 FLAG2=1
1010 FLAG3=1
1020 REM  MAINLINE
1030 REM
1040 REM  FLASH THE CURSOR, CHEC
     K FOR CONTROL INPUT, AND GO
      TO RIGHT SUBROUTINE IF NEC
     ESSARY.
1050 REM  ELSE GO BACK AND DO IT
      ALL AGAIN.
1060 CALL GCHAR(ROW,COL,HOLD)
1070 IF STICK=0 THEN 1090
1080 CALL JOYST(SIDE,X,Y)
1090 CALL KEY(3,K,S)
1100 IF FLAG3=0 THEN 1140
1110 CALL HCHAR(ROW,COL,CURSOR)
1120 CALL HCHAR(ROW,COL,CURSOR+1
     )
1130 CALL HCHAR(ROW,COL,HOLD)
1140 IF (S=0)*(X=0)*(Y=0)THEN 10
     70
1150 IF (S<>0)*(K<67)THEN 1180
1160 GOSUB 1230
1170 GOTO 1060
1180 GOSUB 1450
1190 GOTO 1060
1200 REM
1210 REM  *** MOVE ROUTINE ***
1220 REM
1230 IF FLAG3=0 THEN 1410
1240 IF STICK=0 THEN 1280
1250 ROW1=ROW-Y/4
1260 COL1=COL+X/4
1270 GOTO 1330
1280 FOR I=1 TO 8
1290 IF K=DIR(I,1)THEN 1320
1300 NEXT I
1310 GOTO 1410
1320 ROW1=ROW+DIR(I,3)
1330 IF (ROW1>24)+(ROW1<1)THEN 1
     410
1340 IF STICK=1 THEN 1360
1350 COL1=COL+DIR(I,2)
1360 IF (COL1>30)+(COL1<3)THEN 1
     410
1370 COL=COL1
1380 ROW=ROW1
1390 IF FLAG1=0 THEN 1410
1400 CALL HCHAR(ROW,COL,PUT)
1410 RETURN
1420 REM
1430 REM  *** COMMAND ROUTINE***

1440 REM
1450 FOR I=1 TO 7
1460 IF K=COM(I)THEN 1490
1470 NEXT I
1480 GOTO 1500
1490 ON I GOSUB 1540,1700,1890,1
     980,2050,2130,2230
1500 RETURN
1510 REM
1520 REM  *** CHANGE PEN UP/DOWN
      ***
1530 REM
1540 IF FLAG3=0 THEN 1560
1550 ON FLAG1+1 GOSUB 1570,1620
1560 RETURN
1570 FLAG1=1
1580 PUT=CHR(SET)+CHARACTER-1
```

Continued on p. 26



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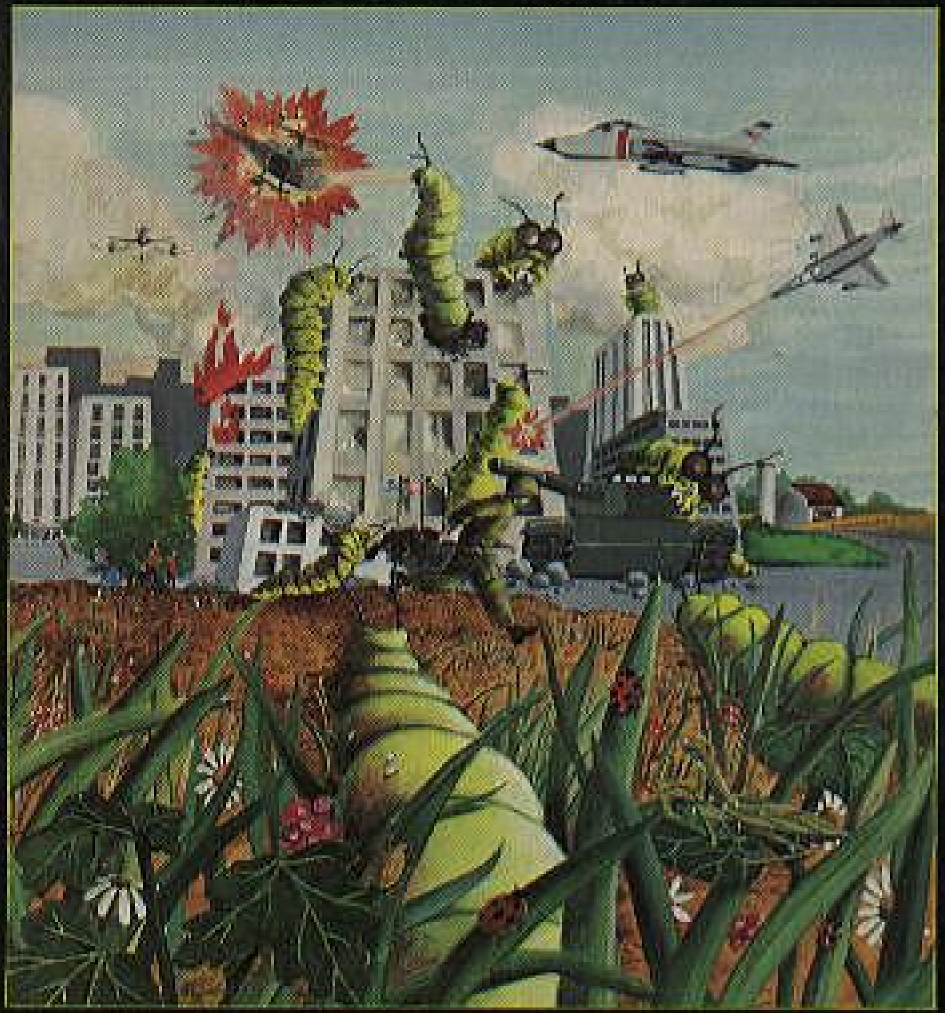
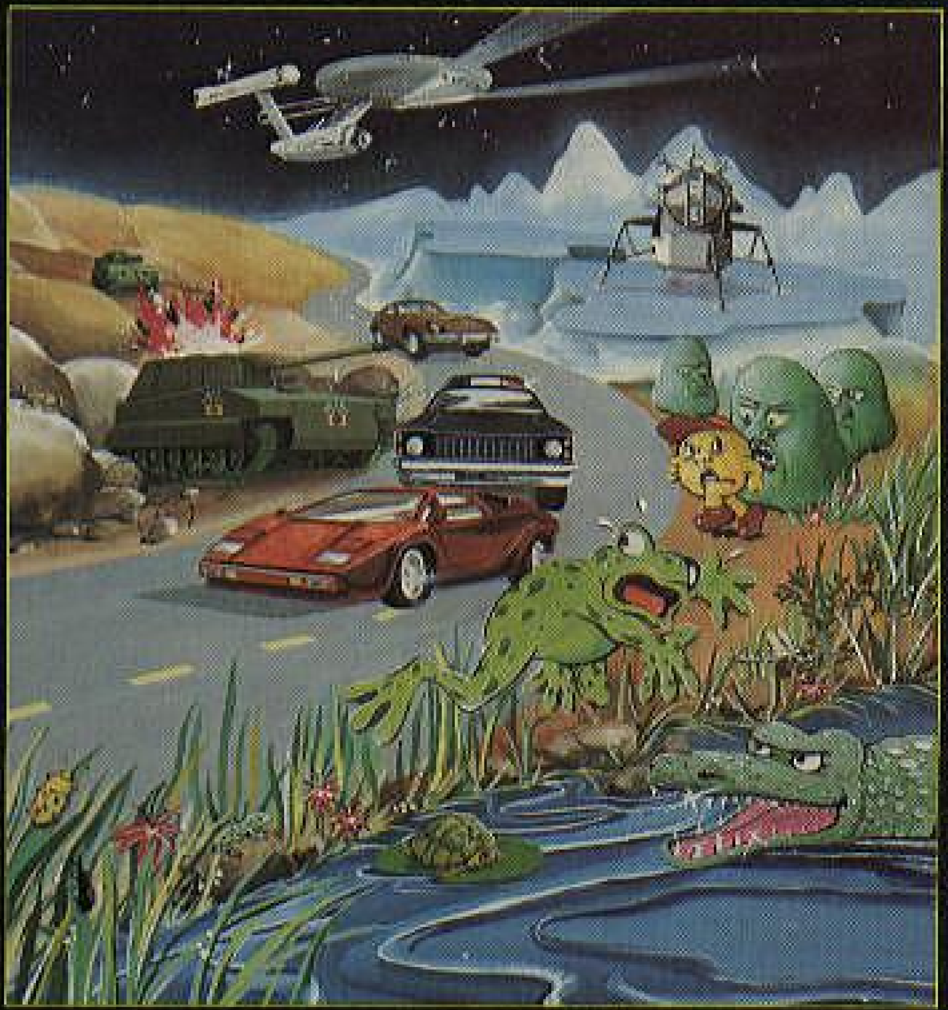
Make Your Mark . . . from p. 24

```
1590 CURSOR=33
1600 CALL HCHAR(ROW,COL,PUT)
1610 RETURN
1620 FLAG1=0
1630 CURSOR=35
1640 IF FLAG2=1 THEN 1660
1650 FLAG2=1
1660 RETURN
1670 REM
1680 REM  ***   CHANGE ERASE/DRA
     W ***
1690 REM
1700 IF FLAG3=0 THEN 1730
1710 ON FLAG2+1 GOSUB 1740,1800
1720 CALL HCHAR(ROW,COL,PUT)
1730 RETURN
1740 FLAG2=1
1750 PUT=CHR(SET)+CHARACTER-1
1760 IF FLAG1=1 THEN 1780
1770 FLAG1=1
1780 CURSOR=33
1790 RETURN
1800 FLAG2=0
1810 PUT=31
1820 CURSOR=37
1830 IF FLAG1=1 THEN 1850
1840 FLAG1=1
1850 RETURN
1860 REM
1870 REM  *** CURSOR UP/DOWN ***
1880 REM
1890 ON FLAG3+1 GOSUB 1910,1930
1900 RETURN
1910 FLAG3=1
1920 RETURN
1930 FLAG3=0
1940 RETURN
1950 REM
1960 REM  *** ERASE ALL ***
1970 REM
1980 FOR I=1 TO 24
1990 CALL HCHAR(I,1,31,32)
2000 NEXT I
2010 RETURN
2020 REM
2030 REM  *** CHANGE SCREEN COLO
     R ***
2040 REM
2050 @SCREEN=@SCREEN+1
2060 IF @SCREEN<=16 THEN 2080
2070 @SCREEN=2
2080 CALL SCREEN(@SCREEN)
2090 RETURN
2100 REM
2110 REM  *** CHANGE PEN  COLOR
     ***
2120 REM
2130 IF (FLAG1=0)+(FLAG2=0)+(FLA
     G3=0)THEN 2190
2140 SET=SET+1
2150 IF SET<=16 THEN 2170
2160 SET=2
2170 PUT=CHR(SET)+CHARACTER-1
2180 CALL HCHAR(ROW,COL,PUT)
2190 RETURN
2200 REM
2210 REM  *** CHANGE SHAPE ***
2220 REM
2230 IF (FLAG1=0)+(FLAG2=0)+(FLA
     G3=0)THEN 2290
2240 CHARACTER=CHARACTER+1
2250 IF CHARACTER<=8 THEN 2270
2260 CHARACTER=1
2270 PUT=CHR(SET)+CHARACTER-1
2280 CALL HCHAR(ROW,COL,PUT)
2290 RETURN
2300 REM
2310 REM  *** INSTRUCTIONS ***
2320 REM
2330 CALL CLEAR
2340 PRINT "WANT INSTRUCTIONS? (
     Y/N)"
2350 CALL KEY(3,K,S)
2360 IF S=0 THEN 2350
2370 IF K=78 THEN 3030
2380 IF K=89 THEN 2410
2390 PRINT "'Y' OR 'N' PLEASE."
2400 GOTO 2350
2410 CALL CLEAR
2420 PRINT "WELCOME TO 'MAKE YOU
     R MARK'":"      THIS PROGRAM
     WILL ALLOW":"YOU TO DRAW DE
     SIGNS OF YOUR"
2430 PRINT "OWN CHOOSING. SIMPLY
       USE":"THE JOYSTICK OR THE
     KEYBOARD":"TO DIRECT THE PE
     N.      WHEN"
2440 PRINT "IT IS DOWN, IT WILL
     DRAW":"ACCORDING TO THE SHA
     PE AND":"COLOR OF POINT YOU
       HAVE":"CHOSEN."
2450 PRINT ::"THE PEN LOOKS LIKE
       THIS:";CHR$(33)
2460 PRINT ::"[PRESS ANY KEY TO
     GO ON]"
2470 CALL HCHAR(20,27,33)
2480 CALL HCHAR(20,27,34)
2490 CALL KEY(0,K,S)
2500 IF S=0 THEN 2470
2510 CALL CLEAR
2520 PRINT "IF YOU WANT TO MOVE
     THE PEN":"AROUND WITHOUT DR
     AWING ANY-":"THING, SIMPLY
     PRESS THE '1'"
2530 PRINT "KEY.   THIS WILL LIFT
       THE PEN":"AND YOU WILL BE
     FREE TO":"MOVE THE PEN WHER
     EVER YOU"
2540 PRINT "WANT WITHOUT LEAVING
       A MARK.":"TO PUT THE PEN B
     ACK DOWN,":"PRESS '1' AGAIN
     ."
2550 PRINT "THE PEN, WHEN 'UP',
     LOOKS":"LIKE THIS:";CHR$(35
     )
2560 PRINT ::"[PRESS ANY KEY TO
     CONTINUE]"
2570 CALL HCHAR(20,13,35)
2580 CALL HCHAR(20,13,36)
2590 CALL KEY(0,K,S)
2600 IF S=0 THEN 2570
2610 CALL CLEAR
```

Continued on p. 73





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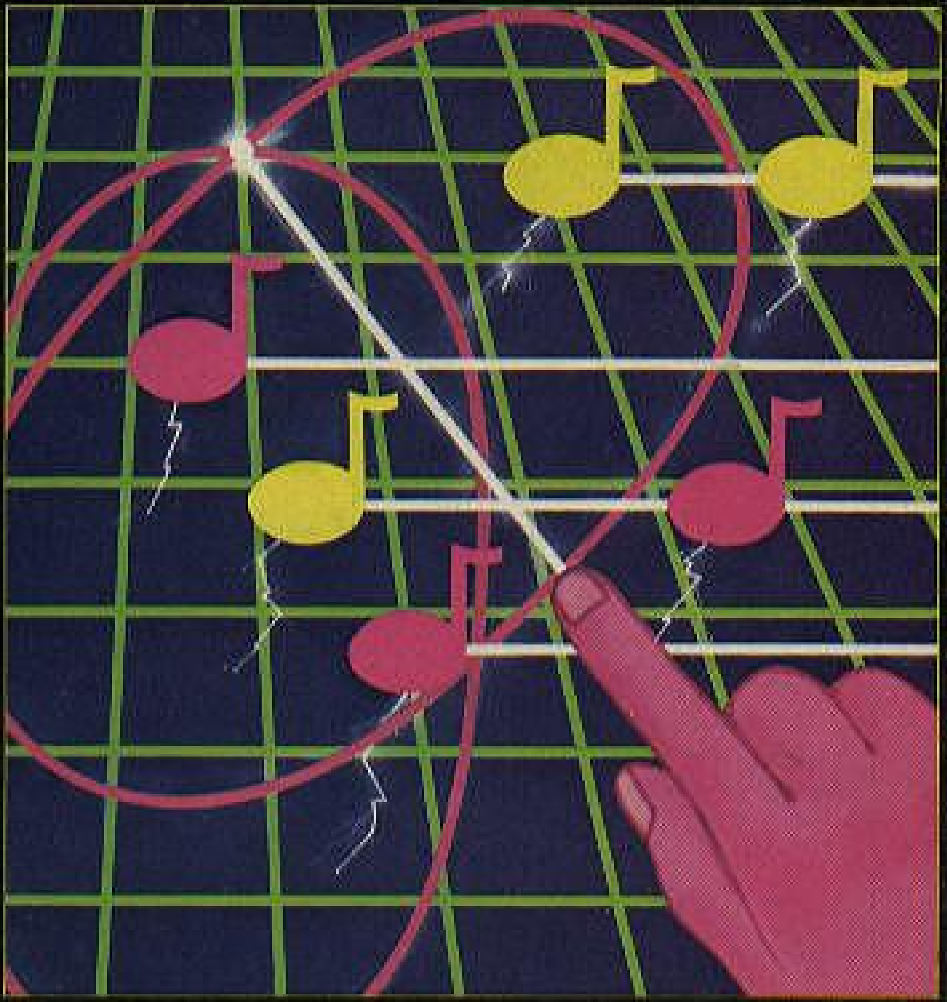

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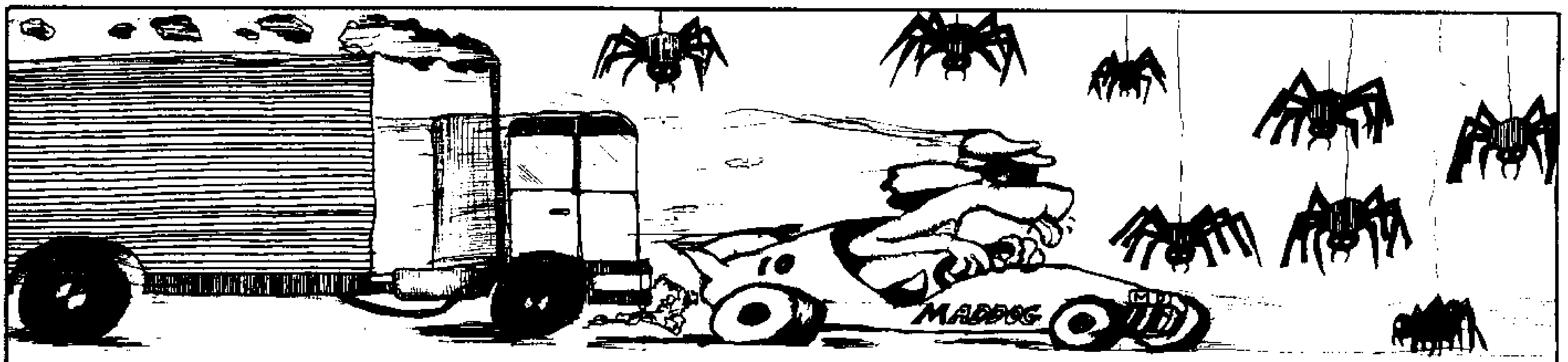

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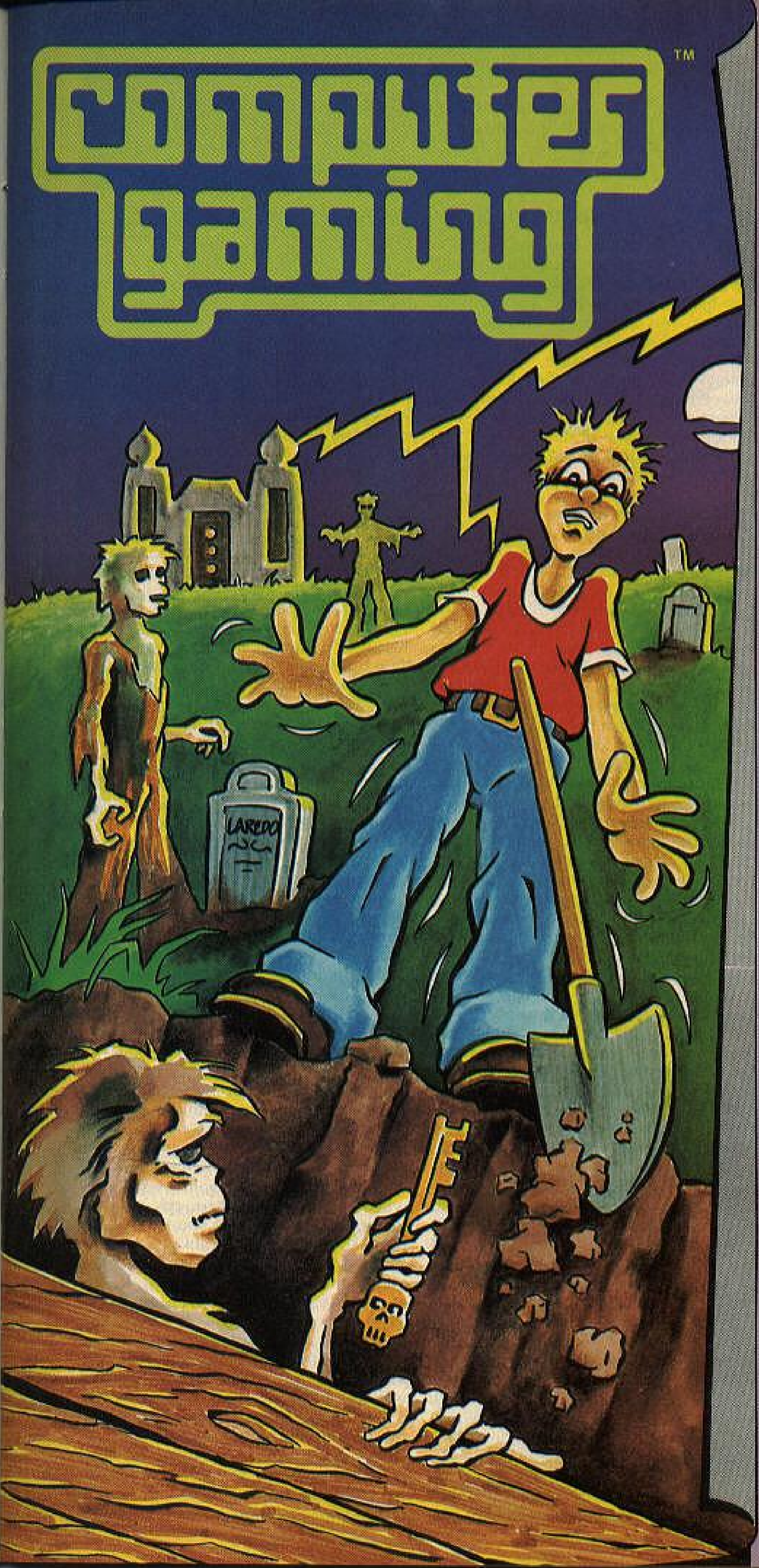


NO REST FOR THE WICKED

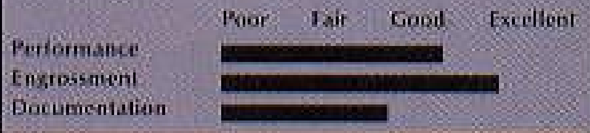
A Review of Zombie Mambo

by Judy Sanoian

99'er HCM Staff

Name:	Zombie Mambo
Program Type:	Adventure Game
Language:	BASIC
Distributor:	TImagination P.O. Box 2805 Fairfield, CA 94533
Price:	$22.95

System Requirements:
Cassette Recorder



The title *"Zombie Mambo"* may conjure up a macabre image of pale, hollow-eyed corpses shuffling in time to a Latin beat. But this game fulfills only half of its title's promise. There is, to be sure, a coterie of somnambular spirits, but these zombies don't exactly boogie to a disco beat, or even a sedate tango. They plod along slowly, as if they might be sporting leg irons.

Those who are wise in the ways of cyber-tainment will immediately nod and say "Ah, typical sluggish BASIC game." It can indeed be difficult to find BASIC games that are fast, complex and challenging. In my opinion, *Zombie Mambo* meets all three of these criteria. First, it is a complex game, offering multiple screens and two separate scenarios. It even has elements of an adventure game in that you must progress through interconnecting chambers of a crypt, using clues to find your way out. Second, the game is extremely challenging on even its easiest level of difficulty. (I challenge anyone to make it to the crypt their first time through!) As for speed, *Zombie Mambo* is one game in which slow motion is appropriate for the scenario. The slow, jerky motion of BASIC is perfectly suited to simulate the dead zombie shuffle.

Continued on p. 46

computer gaming™

Computer Gaming is a section for all game lovers—players, designers, and programmers of microcomputer games. Regular features include product reviews, letters to the editor, player strategy, a question and answer forum, a Hall of Fame for high scorers, tutorial articles on game design and programming, plus interviews with professionals in the world of computer gaming.

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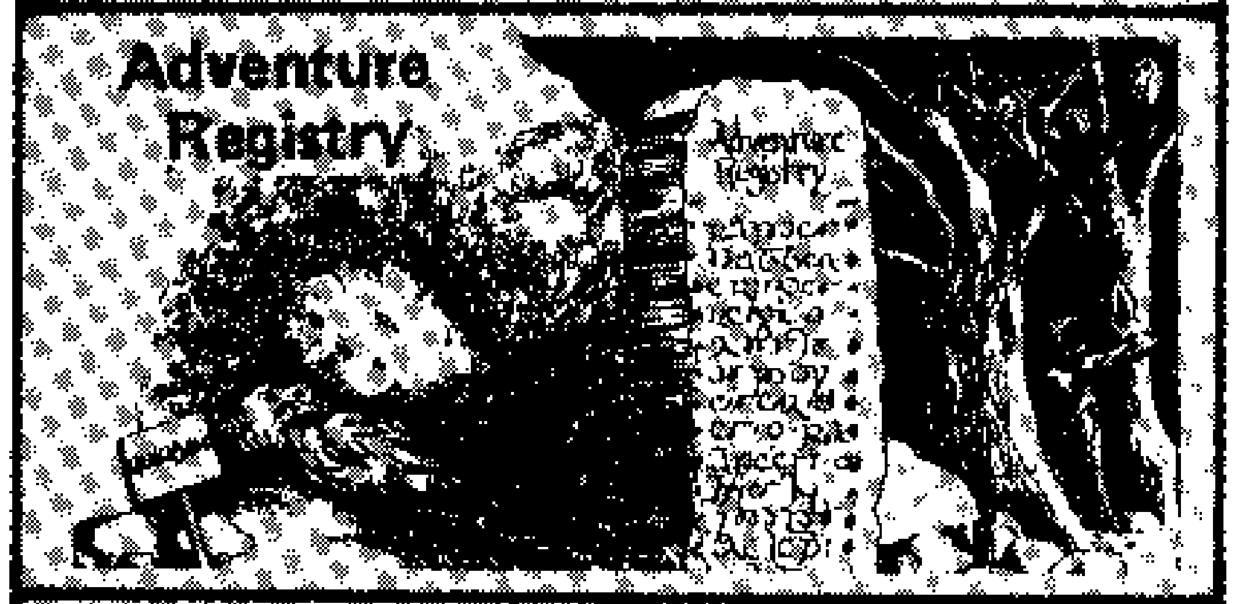
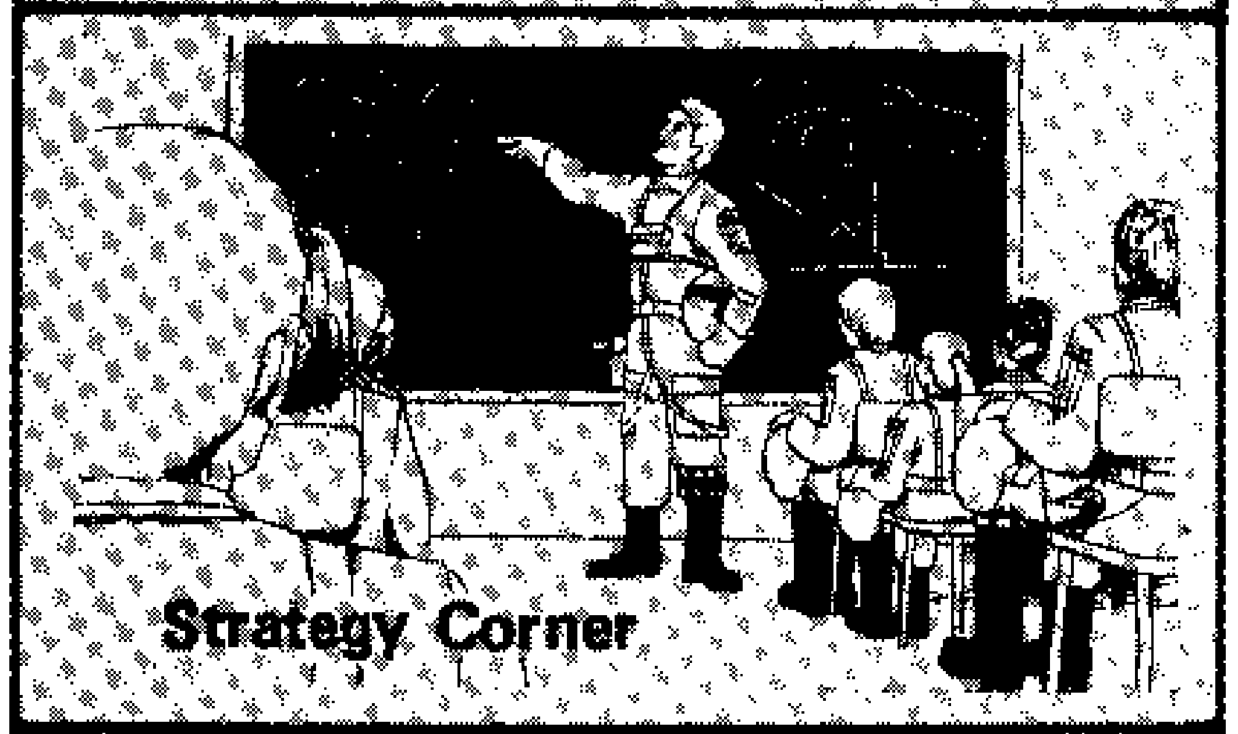
Game Review Criteria

Game Performance measures how well the game responds to the player's commands, rates the quality and realism of the graphics and animation, and examines how well the sound effects, music or speech are integrated into the game. It also determines whether the game delivers what is promised in its advertisements.

Engrossment focuses on that intangible quality that holds the player on the edge of his seat while the hours tick by unnoticed. The game's *staying power* is also assessed.

Documentation rates the printed matter that comes with the game. It notes whether the instructions are clear, comprehensive and easy to use, whether the machine configuration requirements are spelled out, and looks for such information as how to load the program, use the keyboard, and restart the game.





99'er Hall of Fame

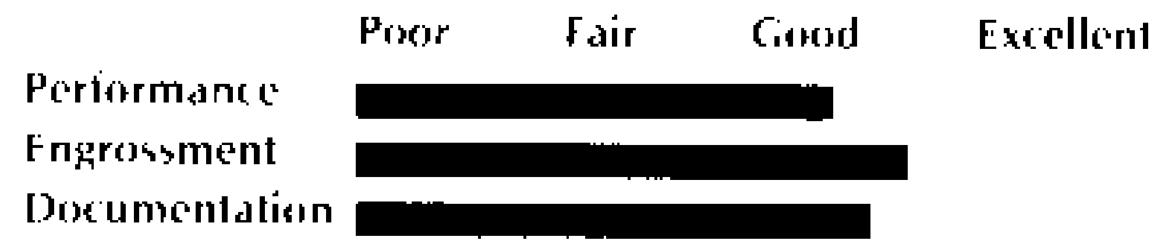
Wyvern

A Review by Erin O'Connor *99'er HCM Staff*

Those of us who majored in English will remember struggling through *Beowulf*, the Old English epic poem from the 7th century. As we all remember, Beowulf was killed by a *wyvern*, a mythical, dragon-like creature who guarded a mound of treasure. In *Wyvern*, Data/Ware's version of the old struggle between dragon and hero, your goal is the wyvern's treasure, which you seek in a random succession of three rooms. You accumulate points as you escape each chamber with treasure.

Name: Wyvern
Medium: Cassette/Diskette
Language: Extended BASIC
Distributor: Data/Ware Development, Inc.
4204 Sorrento Valley Blvd.
San Diego, CA 92121
(800) 382-3282
(800) 882-3282 (CA)
(619) 453-7660 (AK, HI, Can)
Price: $14.95/16.95

System Requirements:
Extended BASIC Cartridge
Joystick #2



Reinforcements on the Way

Beowulf battled his dragon alone, but we latter-day heroes need help. In *Wyvern*, you go into battle with three men and can call on as many as six if you marshal your forces with skill. Your first 1500 points wins you an additional man, and every 2500 points after that wins you another, up to a maximum of six men at any one time. And don't feel sheepish about calling in these reinforcements: Our modern-day wyvern has allies too—a giant spider and troops of baby dragons. We don't think he needs them. He swoops down on the man who enters his chamber with a terrifying swiftness, and if the wyvern himself doesn't kill your hero with his poisonous touch, his independent fire blast will probably incinerate him. This wyvern doesn't stand on ceremony either. He never gives an invading hero a chance to get his bearings but is upon your man the second he crosses—no, approaches—the threshold.

In the two other chambers of the wyvern's citadel are his allies—lesser threats who seem to exist mainly to give your heroes a fighting chance. If your man doesn't drown on his way across the moat, he must take his chances in one of the castle's three rooms. If he's lucky, it won't be the wyvern's: perhaps he'll find himself in the baby dragon chamber, where sprite-generated troops of dragons move across the screen in a medieval freeway formation reminiscent of *Frogger*. On at least the early levels, your hero will be able to negotiate his way through the dragons to pick up the necklaces at the top or bottom of the room. On the first level of play, he can pick up a total of 3 necklaces in any one of the three rooms; on succeeding levels, each room contains a maximum of four treasures. He can't escape a room until he's picked up at least one gem. He advances to the next level of play when he's taken at least one treasure from each room.

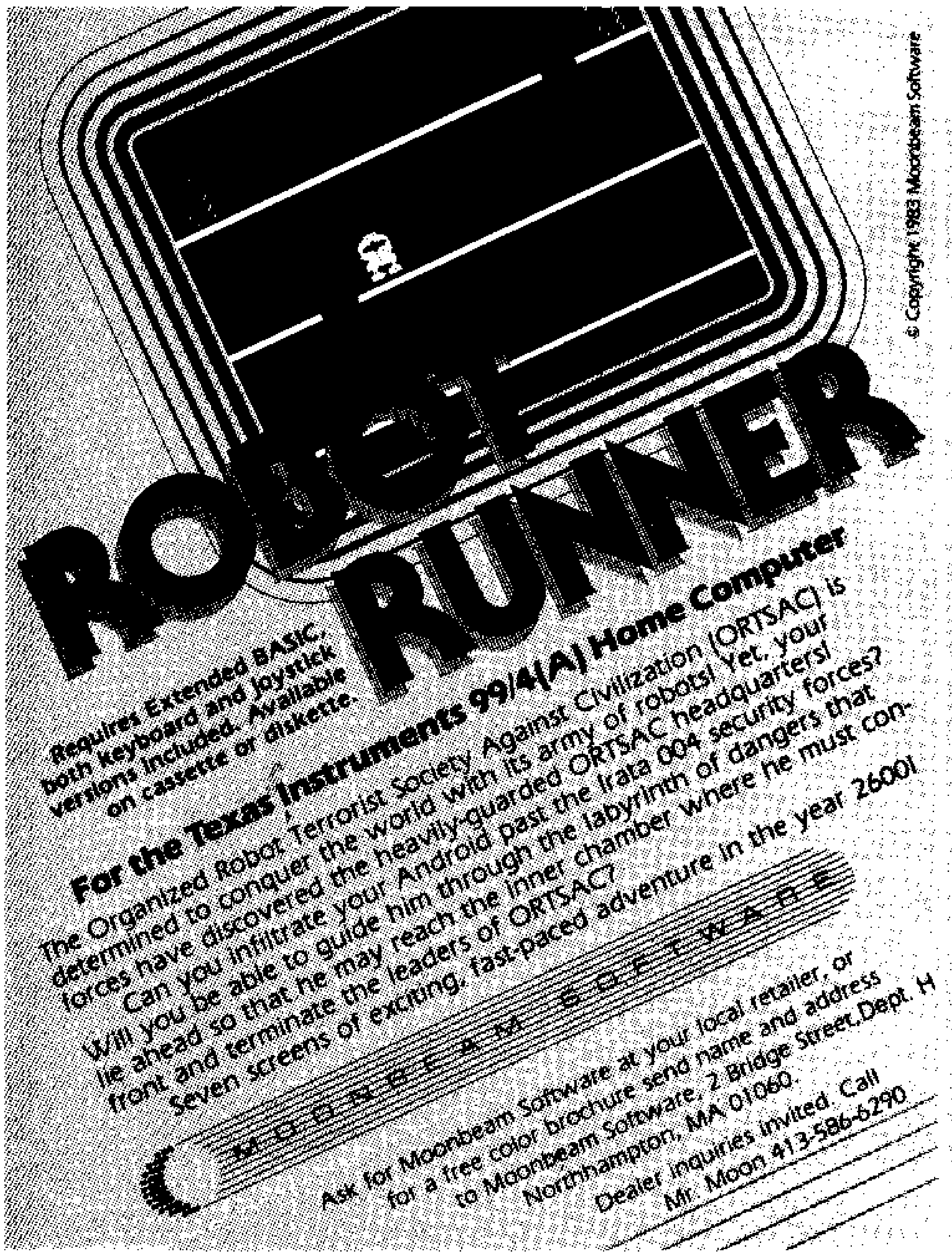
If your hero, or one of his avatars, escapes the baby dragons and fortune still smiles, he'll find himself next in the spider's webby chamber. Here he must make his way to more treasure by outmaneuvering the attacking giant spider and advancing around or through the treacherous spider's web. The cleverly designed m-shaped spider moves about his room spinning even more bits of web as he goes. If your man perches on the web, he may break through it after a short wait, but the spider's advance toward him will accelerate as he sits there.

We found that the shift from room to room (from game-to-game really) keeps interest high, as does the difficulty of the game in each room. Short transition times between rooms and quick waves of reinforcements maintain a good momentum of play. One complaint: The wyvern in his chamber is *too* formidable a foe. On even the lowest levels of play your man often doesn't even make it into the wyvern's chamber, and your rapidly diminishing reserve forces (displayed at the top of the screen under your score) fare no better. Several of us played the game, and only our ace player was able to keep her men—or one of them—alive to escape with treasure.

The Best Defense

Data/Ware's documentation—short on background story and long on helpful hints for loading and playing the game—seems to acknowledge that the wyvern's chamber presents a difficult level of play when it suggests (1) that you pay attention to the unique entrance sound for each room so that you can point your man in some evasive direction even before he enters the room, and (2) that in the wyvern's room, the best evasion is constant motion in all eight directions that your joystick allows. Imitation may be the most effective means of defense. We found that we could best evade the wyvern by emulating his sweeping, triangular flight pattern which goes beyond the boundaries of the room.

As you progress to the upper levels of play, the wyvern's attack speeds up; the baby dragons move along their freeway in thicker and faster formation; and the spider


ROBOT RUNNER

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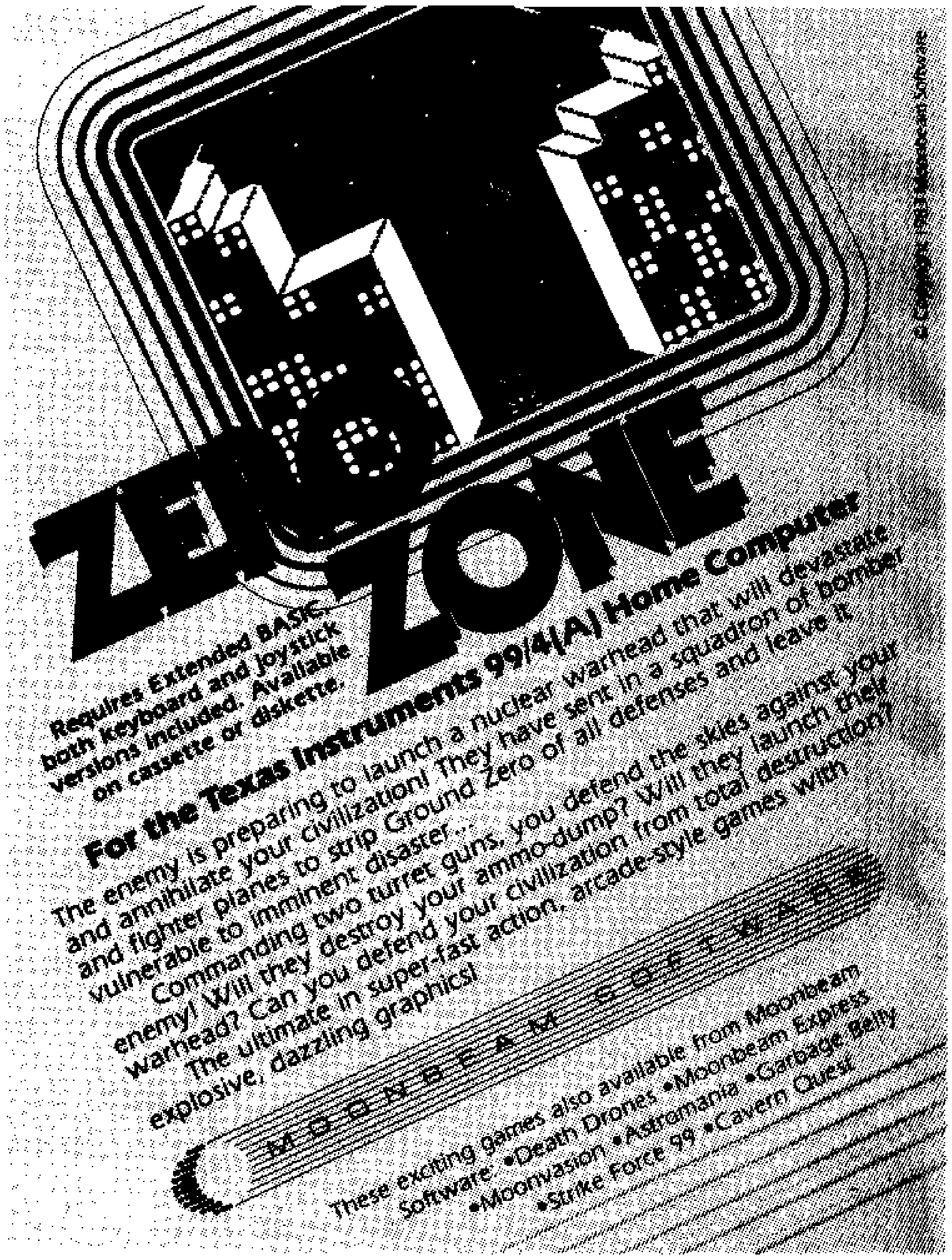
ZERO ZONE

Requires Extended BASIC, both keyboard and joystick versions included. Available on cassette or diskette.

For the Texas Instruments 99/4(A) Home Computer

The enemy is preparing to launch a nuclear warhead that will devastate and annihilate your civilization! They have sent in a squadron of bomber and fighter planes to strip Ground Zero of all defenses and leave it vulnerable to imminent disaster... Commanding two turret guns, you defend the skies against your enemy! Will they destroy your ammo-dump? Will they launch their warhead? Can you defend your civilization from total destruction? The ultimate in super-fast action, arcade-style games with explosive, dazzling graphics!

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spins more complex and stronger webs.(Your man must wait longer to break through.) At the same time that your foes get faster and offer more frequent attacks, your poor heroes tire and slow down. While this is in keeping with the story logic, it doesn't seem quite fair; a skillful player with quick reflexes can feel hampered and even hopeless as his heroes respond with maddening slowness to intensified attacks. Given this limited ability to respond, positioning rather than speed is the only tactic left a player.

We liked the ingenious simplicity of *Wyvern's* graphics. The citadel is quite adequately suggested by a stone-like outline. The wyvern himself is a graphics triumph, looking like the real thing, though the action of his fire blast seems oddly independent of its owner. But even if the behavior of the fire blast is a departure from traditional accounts of dragons, it nevertheless contributes to the high level of difficulty you'll encounter in the wyvern's chamber. Some of us felt that the baby dragons looked more like baby dragonflies, but this is just a quibble in our generally high regard for *Wyvern's* inventive use of sprites. The treasure is recognizably made up of necklaces and rings, and in a room crowded with baby dragons or a fast-growing spider web you'll find yourself grateful for a treasure large enough to spot easily.

Wyvern's scenario is a bit sketchy, but we didn't mind the documentation's spending so little time on "the story." The brief paragraph devoted to a history of the wyvern's citadel and treasure is really all that's needed for so familiar a tale, and it's a refreshing change from the poorly written elaborate narratives of so many fantasy games. The documentation moves quickly from establishing the scenario to an orderly sequence of clear instructions and strategy tips.

The strategy tips are especially appreciated, as *Wyvern* presents a combination of difficult games that verge on the impossible. Our players found this more challenging than discouraging, and we think you'll want to cross that moat and undergo the Wyvern's varieties of hospitality too.

Note: If you are loading this program from cassette and *do not* have the 32K Memory Expansion, you must disconnect your disk drive in order to make the game run. If loading from diskette, you must have the 32K Memory Expansion in order for *Wyvern* to run. Also, the game is programmed to run with Joystick #2 of the double joystick. It will not run with a single joystick or Joystick #1. 99'er

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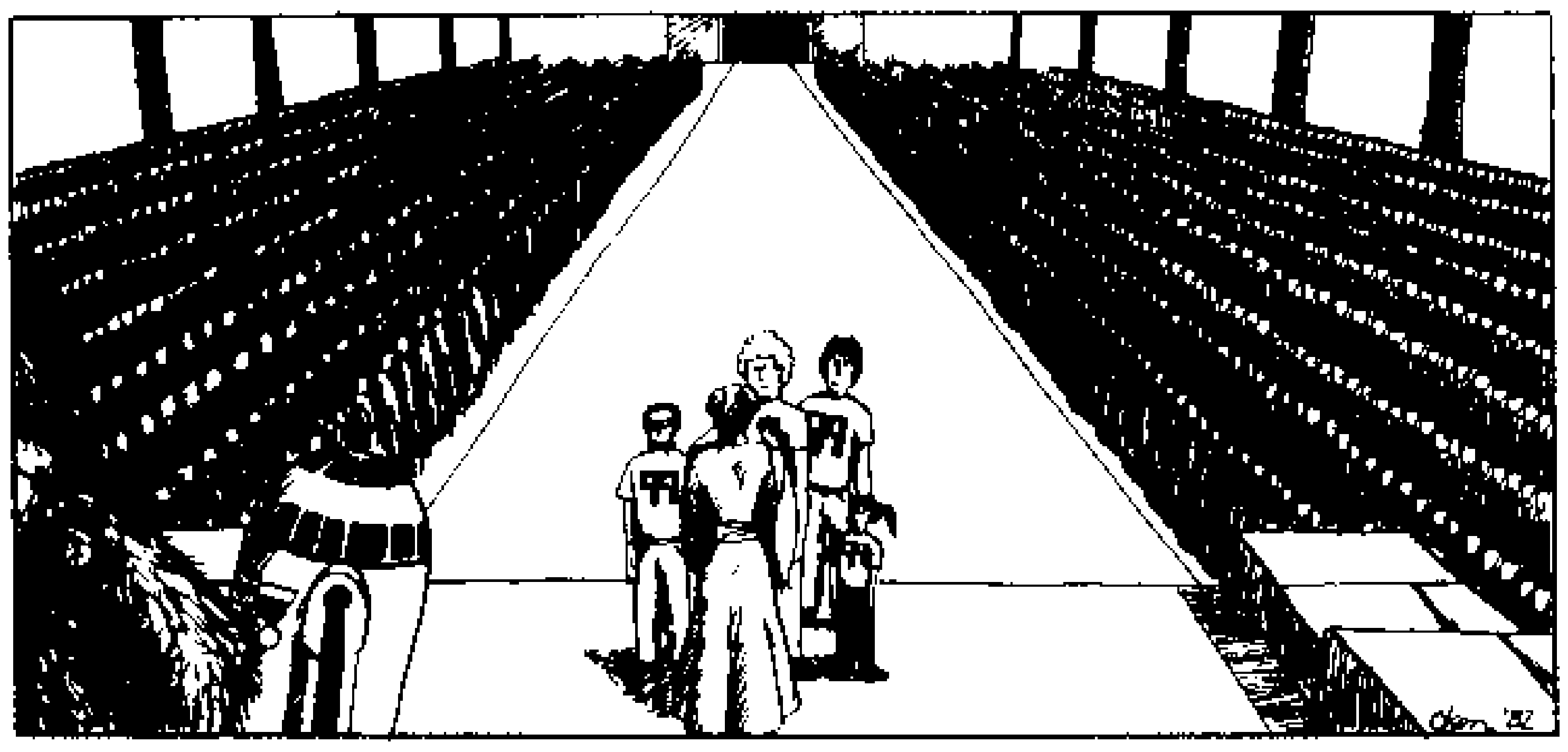

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Name: **Michael Strout (Scarborough, ME)**
Game: **Alpiner**
Score: **94,599**

Name: **Dave Miller (Lynchburg, VA)**
Game: **TI Invaders**
Score: **46,192**

Name: **Mike Newman, age 16 (Montesano, WA)**
Game: **Henhouse**
Score: **132,570**

Name: **Brent Shearer (Spring Grove, PA)**
Game: **Attack**
Score: **1,318,450**

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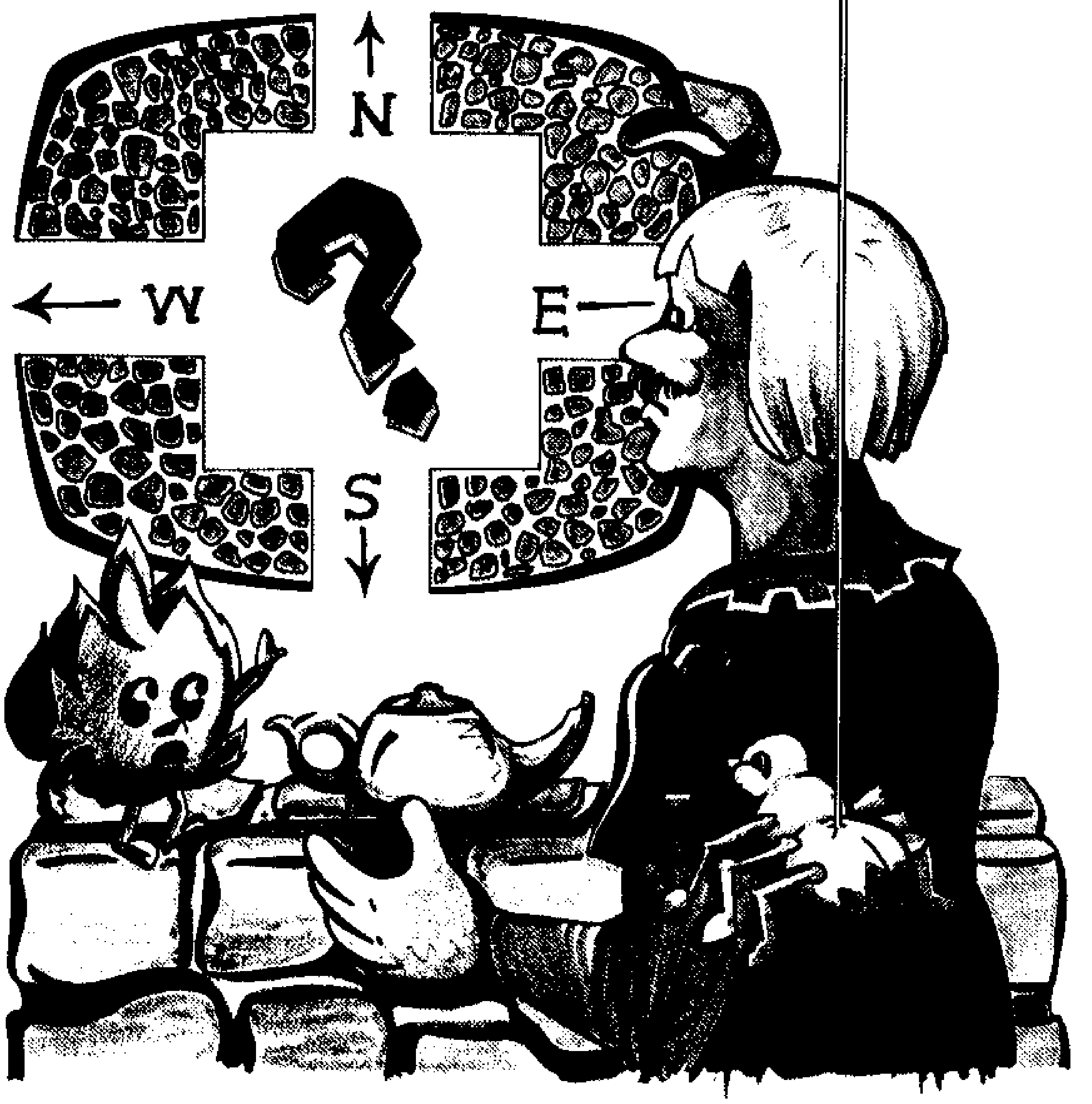

Escape from Wizard's Keep

by Jack Kitchens
198 Fairfield Ave.
Kenmore, NY 14223

You just can't seem to please anyone these days. The evil wizard, Torlik, has been insulted because you mispronounced his name. So he's locked you in the dungeon beneath his fortress keep. While sitting around in your cell, you notice a loose stone in the cell wall and move it, revealing a passage. Entering the passage, you find five objects hidden away by the wizard. Take these objects with you, for now you are in the labyrinth below the wizard's keep and you will need them to find your way out. From stories you have heard in the past, you know that one of the five objects is a magic charm (but you can't remember which one) and if you can find the magic room while you are holding the magic charm and say the magic word, you will escape.

The Game

Escape From Wizard's Keep, a text/graphics adventure written in Extended BASIC, does not require joysticks for game play. You can move about the labyrinth beneath the wizard's keep by saying NORTH, SOUTH, EAST, WEST. You have 5 objects—an amulet, gem, bottle, rock and lamp—to help you in your search for an escape route.You must use the names of the objects in combination with DROP to find your way through the labyrinth. Other words you may want to use are GET, SAY, QUIT, GO, TAKE, and LEAVE. One of the five objects is the magic charm, and the name of one of the other four objects is the magic word.

Wizard's Hazards

If you have the magic charm and say the magic word when you're in the magic room, you will escape. If any one of the three ingredients is missing, you will be transported to an ordinary room. You must beware of the Fire Pit and avoid getting trapped in a room without any doors. As in most adventures, the best strategy is to make a map. Drop an object and note where you dropped it (that's what the objects are for). When you return to a room containing the object, observe how you got there. If you go from one room to another by moving in a certain direction, you may not be able to return to the same room by going in the reverse direction. Some passageways even lead back to the room they come from! The labyrinth is also inhabited by many little creatures, like the Fire Beasts, who appear from time to time. When you meet these creatures they will give you advice on which direction to take. Don't always believe them, for they lie as often as not.

Fame and Fortune

Dedicated adventurers who play this game may want to send in their record-breaking playing times to *Hall of Fame*. Be sure to have the signature of a witness to verify your phenomenal adventuring speeds! Those of you who remain lost in the maze for hours, may begin to lose hope. Trust us—there is a solution. If you do finally give up, check out the November issue. We will print a solution—a sure-fire plan of escape—for you to use. Look for it in the *Adventure Registry*. Meanwhile, for those of you who still believe in magic, see how many solutions *you* can conjure up!

Escape From Wizard's Keep
Explanation of the Program

Line Nos.	
100-160	Title header.
170-230	Title screen.
240-260	Maze input.
270	Starting room.
280-430	Characters, objects, and walls.
450-500	Object assignment and color schemes.
510-530	Initialization and game start.
540-810	Passageways.
820-880	Normal room.
890-1030	Doorless room and Fire Pit.
1040-1260	Game setup.
1270-1290	Magic room.
1300-1340	Freedom.
1350-1430	Sentence splitting.

Continued on p. 40

Grisly Adventure

by Robert Schenk

424 Jackson
Rensselaer, IN 47978

The great outdoors beckons us to the land of the big pines, crisp air, and, of course, the grizzly bear. In this game you go on a bear hunt deep in the wilderness, far from any roads or human settlements. To get to the happy hunting grounds you load up a canoe with supplies and start down the Ursus River. To reach the remote area where the bear lives, you must shoot the Thunderbolt Rapids. As the boat lurches forward, you will need all your skill to avoid the rocky shore or a submerged boulder. Though it may sometimes appear that there is no way through, there is always at least one safe path. If the canoe capsizes, you must swim for your life.

Upon arriving at the bear's lair, you hop from the canoe and begin tracking him down. Remember that bears are unpredictable, and if you don't shoot fast, you may end up a grizzly dinner. If you do shoot the bear, you must retrieve him and bear him back to the canoe.

Hunting time is limited, so make every move count. Your canoe cannot handle a heavy load of supplies, and if you are capsized in the rapids, you may have barely any left. If you do not leave the hunting grounds before your supplies run out, you will lose your bearings and die of hunger and exposure.

If you manage to stay alive, there is only one more obstacle left to overcome—a final series of rapids. If you capsize in the whitewater of Tooth and Claw Gorge, you will lose the bear (*if* you have one) and perhaps drown as well!

Your Days Are Numbered

There are three levels of play to choose from. On the first two levels you only have to shoot three sets of rapids at the beginning and at the end. Once you begin hunting, the bear will be in sight at all times. These levels give you the most time to hunt. On level three you must shoot four rapids, and once you begin the hunt, you will see the bear only when it is very close. Hunting time will be short on this level, and your gun range will be more limited.

You will begin the hunt with a rifle, a pistol, and plenty of supplies. Each time you capsize or run aground in the rapids, some of these resources will be lost. If you capsize once, you lose the rifle and must shoot the bear twice with your pistol to kill it. Loss of supplies means less time to kill the bear. The remaining time allotted for the hunt is indicated by a red bar at the bottom of the screen. If you do not finish the bear hunt and your canoe goes off the screen before the time is used up, you will die of exposure and starvation.

Survival Skills

Use the arrow keys to steer your canoe. You must make sure, however, that the Alpha Lock key is up, or else you will not be able to move during the hunt. The arrows on the keys indicate their direction. When hunting the bear, you shoot by pressing the appropriate arrow key and the shift key at the same time. Thus, an uppercase [E] will cause the gun to shoot toward the top of the screen, but a lower-case [e] will move you toward the top of the screen. With a little practice you will find the keys easy to use. There are two other keys you will need to use in order to survive this grisly adventure. To get out of the canoe and begin the hunt you must move the canoe to shore and press [o] (for "out," of course). To get back into the canoe, you must move back to the shore next to the canoe and press [i] (for "in"). If you try to land by pressing [o] and nothing happens, make sure that (1) you are not pressing zero, (2) you are next to land, and (3) there is no tree in the way. After all, you cannot land on top of a tree! You cannot hunt the bear from your canoe because you must be on land for the hunting keys to work.

When you first begin the game, it might be useful to simply maneuver through the rapids until you have mastered them. Then try hunting at the lowest level. Only when you consistently finish as a great hunter at the lowest level (the cub-hunter level) are you ready to move up to levels 2 and 3. So let's pack our supplies and move out to Bear Country—once you've been there, leaving may be un*bear*able.

Grisly Adventure
Explanation of the Program

Line Nos.	
100-140	Program header.
150-240	Initialize array A( ).
250-340	Set up character patterns and colors.
350-840	Display playing screen.
850-1120	Main control loop to move the canoe through the rapids.

Continued on p. 37

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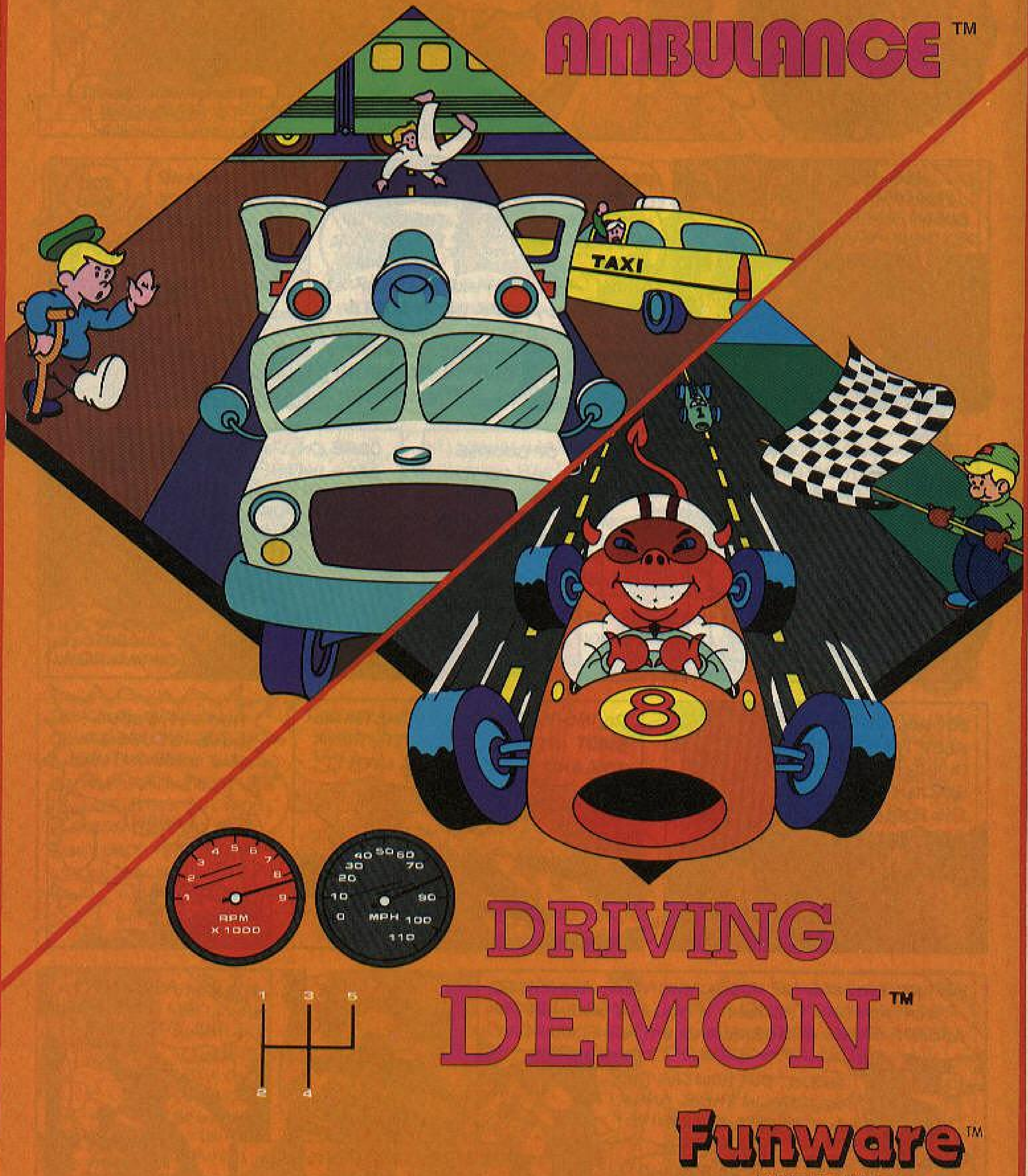
TAXI
8
1
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RPM
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60
70
90
MPH 100
110
1
3
5
2
4

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Grisly Adventure . . . from p. 33

1130-1330	End of game. Option to play again.
1340-1430	Subroutine to display a string without scrolling.
1440-1620	Subroutine to display the trees.
1630-2160	Set up the maze and the bear.
2170-2400	Move canoe to the maze.
2410-2890	Control loop to move through the maze.
2900-3560	Subroutines to handle events in the maze. End-of-game messages.
3570-3730	Initialize variables for a new game.
3740-3910	Input level of difficulty.
3920-3990	Game data.
4000	End of the game.

```
 100 REM  ********************
 110 REM  * GRISLY ADVENTURE *
 120 REM  ********************
 130 REM  BY ROBERT RENSSELAER
 140 REM  99'ER VERSION 2.12.1
 150 OPTION BASE 1
 160 DIM A(31,11)
 170 CALL CLEAR
 180 RANDOMIZE
 190 FOR I=1 TO 31
 200 A(I,1)=10
 210 A(I,11)=10
 220 NEXT I
 230 DATA 10,10,10,10,10,10,400,
     350,300,-300
 240 READ A(1,10),A(2,10),A(3,10
     ),A(29,10),A(30,10),A(31,10
     ),SN(2),SN(3),SN(4),SN(5)
 250 RESTORE 3940
 260 FOR X=1 TO 22
 270 READ B,A$
 280 CALL CHAR(B,A$)
 290 NEXT X
 300 FOR X=1 TO 5
 310 READ D,B,C
 320 CALL COLOR(D,B,C)
 330 NEXT X
 340 GOTO 3570
 350 GOSUB 370
 360 GOTO 1630
 370 CALL CLEAR
 380 CALL COLOR(9,3,13)
 390 CALL HCHAR(1,1,96,320)
 400 M=1
 410 K=3
 420 CALL COLOR(10,2,13)
 430 GOSUB 1440
 440 K=5
 450 GOSUB 1440
 460 K=6
 470 GOSUB 1440
 480 GOSUB 1440
 490 CALL HCHAR(18,1,137,224)
 500 CALL SCREEN(13)
 510 FOR I=3 TO 27 STEP 2
 520 CALL HCHAR(INT(RND*5+19),I,
     138,2)
 530 NEXT I
 540 F=14
 550 R=-1
 560 CALL HCHAR(11,1,150,32)
 570 CALL HCHAR(17,1,149,32)
 580 CALL HCHAR(12,1,130,160)
 590 IF R=W THEN 1120
 600 X=INT(RND*5)+2
 610 R=R+1
 620 D=1
 630 J=2
 640 T=R+2
 650 Z=-1-R
 660 U=1-R*.15
 670 A(J,X)=T
 680 A(J+1,X)=T
 690 IF R>1 THEN 710
 700 A(J+2,X)=T
 710 ON INT(RND*1.55+1.75)GOTO 7
     20,750,770
 720 IF (X-D>6)+(X-D<2)THEN 770
 730 D=-D
 740 GOTO 760
 750 IF (X+D>6)+(X+D<2)THEN 720
 760 X=X+D
 770 X4=INT(RND*5+2)
 780 IF A(J,X4)=T THEN 770
 790 A(J,X4)=Z
 800 CALL HCHAR(10+X4,J,132)
 810 IF RND>U THEN 770
 820 J=J+1
 830 IF J<27 THEN 670
 840 I=31
 850 CALL KEY(3,X,Y)
 860 I=I-1
 870 IF X=69 THEN 900
 880 IF X=88 THEN 920
 890 GOTO 930
 900 F=F-1
 910 GOTO 930
 920 F=F+1
 930 CALL HCHAR(F,I,115,2)
 940 IF (F<12)+(F>16)THEN 1000
 950 IF (A(I,F-10)=Z)+(A(I+1,F-1
     0)=Z)THEN 1010
 960 IF I=1 THEN 580
 970 CALL SOUND(SN(T),-5,20)
 980 CALL HCHAR(F,I,130,2)
 990 GOTO 850
1000 F=14
1010 CALL SOUND(1500,110,13,1000
     ,15,-7,3)
1020 FOR K=I TO 1 STEP -1
1030 CALL GCHAR(14,K,G)
1040 CALL HCHAR(14,K,117)
1050 CALL SOUND(200,-5,20)
1060 CALL HCHAR(14,K,G)
```

Continued on p. 38

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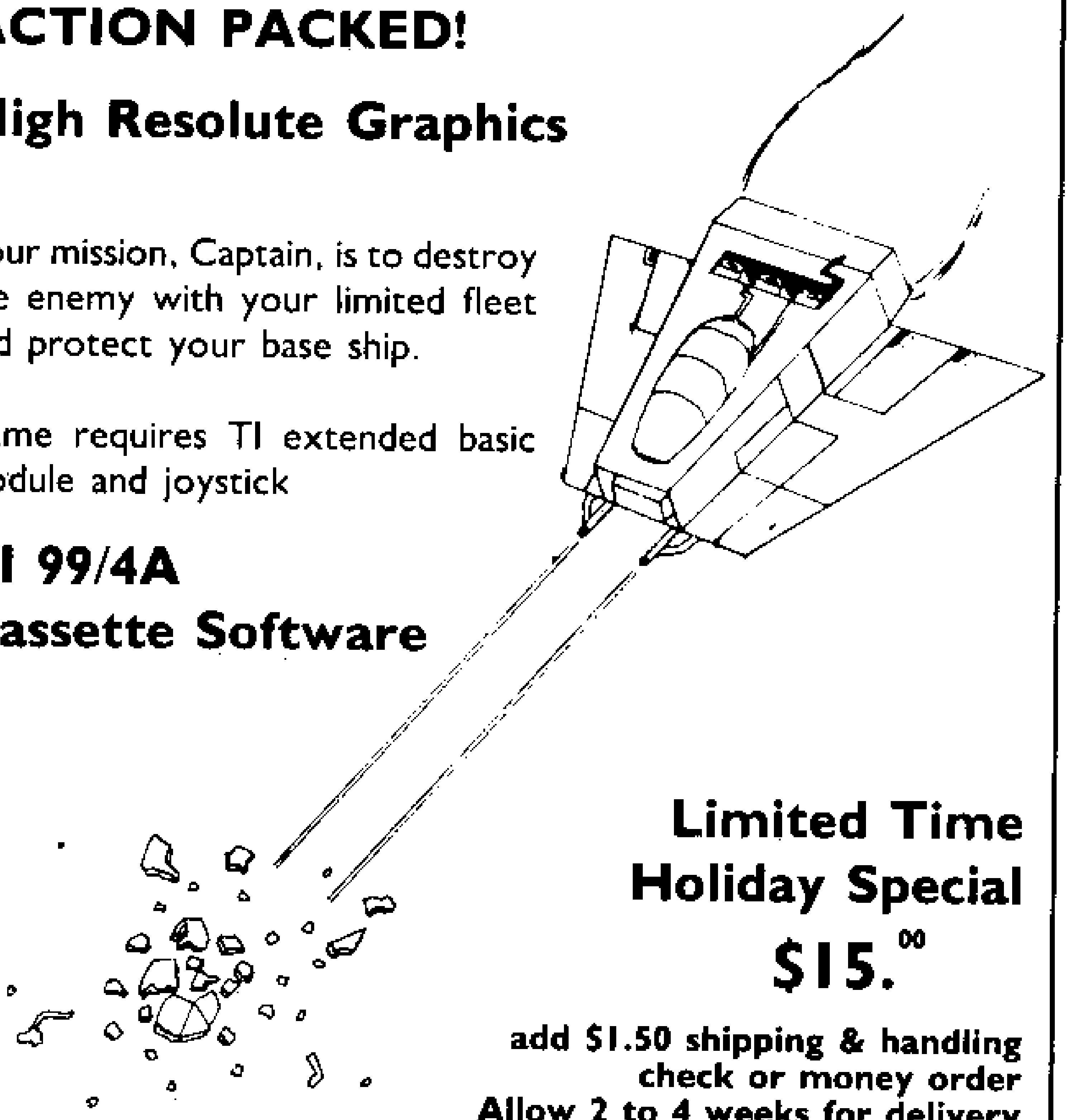

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Grisly Adventure . . . from p. 37

```
1070 NEXT K
1080 A(30,7)=A(30,7)-7
1090 H=0
1100 IF A(30,7)<A(1,7)THEN 3490
1110 GOTO 560
1120 RETURN
1130 K=22
1140 M=2
1150 GOSUB 1360
1160 A$="WANT TO PLAY AGAIN?"
1170 K=24
1180 M=2
1190 GOSUB 1360
1200 CALL HCHAR(12,1,130,160)
1210 J=30
1220 R=0
1230 R=1-R
1240 CALL HCHAR(14,J,115,2)
1250 CALL KEY(3,I,K)
1260 IF I=78 THEN 4000
1270 IF I=89 THEN 3570
1280 IF R=0 THEN 1300
1290 CALL HCHAR(14,J,130,2)
1300 J=J-R
1310 IF J>1 THEN 1230
1320 J=30
1330 GOTO 1230
1340 FOR NL=1 TO L
1350 READ K,M,A$
1360 FOR I=1 TO LEN(A$)
1370 CALL HCHAR(K,M+I,ASC(SEG$(A
     $,I,1)))
1380 NEXT I
1390 IF NL=0 THEN 1430
1400 NEXT NL
1410 L=1
1420 NL=0
1430 RETURN
1440 I=0
1450 M=M+2
1460 CALL HCHAR(K,M,154)
1470 CALL HCHAR(K,M+1,155)
1480 CALL HCHAR(K+1,M,156)
1490 CALL HCHAR(K+1,M+1,157)
1500 CALL HCHAR(K+2,M,158)
1510 CALL HCHAR(K+2,M+1,159)
1520 CALL HCHAR(K+3,M,137)
1530 CALL HCHAR(K+4,M,138)
1540 CALL VCHAR(K+3,M+1,104,2)
1550 I=I+1
1560 ON I GOTO 1450,1570,1620
1570 M=M+1
1580 CALL HCHAR(K+1,M+1,152)
1590 CALL HCHAR(K+2,M+1,153)
1600 CALL VCHAR(K+3,M+1,105)
1610 GOTO 1450
1620 RETURN
1630 CALL HCHAR(1,1,137,320)
1640 CALL COLOR(9,4,12)
1650 CALL HCHAR(10,5,96,23)
1660 FOR I=4 TO 28 STEP 2
1670 IF I=28 THEN 1690
1680 CALL VCHAR(2,I+1,96,8)
1690 FOR J=2 TO 9
1700 A(I,J)=10
1710 NEXT J
1720 NEXT I
1730 FOR I=6 TO 24 STEP 6
1740 F=INT(RND*5)+4
1750 A(I,F)=0
1760 CALL HCHAR(F,I,96)
1770 G=INT(RND*(F-3))+2
1780 A(I,G)=0
1790 CALL HCHAR(G,I,96)
1800 A(I+1,G+1)=10
1810 CALL HCHAR(G+1,I+1,137)
1820 F=INT(RND*5+2)
1830 IF F=G+1 THEN 1820
1840 A(I+2,F)=0
1850 CALL HCHAR(F,I+2,96)
1860 G=INT(RND*(7-F))+F
1870 A(I+2,G)=0
1880 CALL HCHAR(G,I+2,96)
1890 A(I+3,G+1)=10
1900 CALL HCHAR(G+1,I+3,137)
1910 A(I+4,10)=10
1920 CALL HCHAR(10,I+4,137)
1930 A(I+4,9)=0
1940 CALL HCHAR(9,I+4,96)
1950 A(I+4,3)=0
1960 CALL HCHAR(3,I+4,96)
1970 NEXT I
1980 A(4,10)=10
1990 CALL HCHAR(10,4,137)
2000 A(28,9)=10
2010 CALL HCHAR(9,28,137)
2020 A(28,3)=10
2030 CALL HCHAR(3,28,137)
2040 N=14
2050 O=30
2060 CALL HCHAR(N,O,115,2)
2070 G=INT(RND*4+1)*6-1
2080 CALL COLOR(10,2,11)
2090 F=INT(RND*5)+3
2100 D=1
2110 CALL HCHAR(24,3,116,A(30,7)
     -3)
2120 CALL HCHAR(22,5,84)
2130 CALL HCHAR(22,6,73)
2140 CALL HCHAR(22,7,77)
2150 CALL HCHAR(22,8,69)
2160 C=9
2170 CALL KEY(3,I,J)
2180 CALL HCHAR(N,O,130,2)
2190 IF I=83 THEN 2230
2200 IF I=69 THEN 2280
2210 IF I=88 THEN 2310
2220 IF I=79 THEN 2410 ELSE 2250
2230 O=O-1
2240 IF O=1 THEN 3260
2250 CALL HCHAR(N,O,115,2)
2260 GOSUB 2340
2270 GOTO 2170
2280 IF N=12 THEN 2260
2290 N=N-1
2300 GOTO 2250
2310 IF N=16 THEN 2260
2320 N=N+1
2330 GOTO 2250
2340 C=C-1
2350 IF C>-1 THEN 2400
2360 A(30,7)=A(30,7)-1
2370 C=A(30,8)
2380 CALL HCHAR(24,A(30,7),137)
2390 IF A(30,7)=3 THEN 3440
2400 RETURN
2410 IF N>12 THEN 2250
2420 IF A(O,10)=10 THEN 2250
2430 CALL HCHAR(N,O,115,2)
2440 P=N-2
2450 X6=O
2460 J=1
2470 CALL HCHAR(P,X6,96)
2480 CALL KEY(5,I,K)
2490 IF I=101 THEN 2660
2500 IF I=120 THEN 2670
2510 IF I=115 THEN 2700
2520 IF I=100 THEN 2710
2530 IF I=105 THEN 2900
2540 IF I=83 THEN 2820
```

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```
2550 IF I=69 THEN 2740
2560 IF I=68 THEN 2830
2570 IF I=88 THEN 2750
2580 CALL HCHAR(P,X6,107)
2590 GOSUB 2340
2600 IF H<=1 THEN 2910
2610 IF (F<>P)+(G<>X6)THEN 2460
2620 H=2000
2630 CALL SOUND(800,220,5,330,6,
     440,7)
2640 F=0
2650 GOTO 2460
2660 J=-1
2670 IF A(X6,P+J)=10 THEN 2580
2680 P=P+J
2690 GOTO 2580
2700 J=-1
2710 IF A(X6+J,P)=10 THEN 2580
2720 X6=X6+J
2730 GOTO 2580
2740 J=-1
2750 CALL SOUND(5,110,1,-3,1)
2760 FOR I=P+J TO P+Q*J STEP J
2770 IF (I<>F)+(X6<>G)THEN 2800
2780 CALL SOUND(1000,300,3)
2790 H=H+1
2800 NEXT I
2810 GOTO 2580
2820 J=-1
2830 CALL SOUND(5,110,1,-3,1)
2840 FOR I=X6+J TO X6+Q*J STEP J
2850 IF (I<>G)+(P<>X1)THEN 2880
2860 CALL SOUND(1000,330,3)
2870 H=H+1
2880 NEXT I
2890 GOTO 2580
2900 IF (P=10)*(X6=O)+(P=10)*(X6
     =O+1)THEN 2170 ELSE 2580
2910 CALL HCHAR(F,G,96)
2920 IF (F=P)*(G=X6)THEN 3540
2930 V(1)=0
2940 V(2)=0
2950 V(3)=0
2960 V(4)=0
2970 IF A(G,F+1)=10 THEN 2990
2980 V(1)=1
2990 IF A(G+1,F)=10 THEN 3010
3000 V(2)=1
3010 IF A(G,F-1)=10 THEN 3030
3020 V(3)=1
3030 IF A(G-1,F)=10 THEN 3050
3040 V(4)=1
3050 B=D-2
3060 IF B>0 THEN 3080
3070 B=B+4
3080 ON V(1)+V(2)+V(3)+V(4)GOTO
     3090,3110,3120,3120
3090 D=B
3100 GOTO 3150
3110 IF (V(1)+V(3)=0)+(V(2)+V(4)
     =0)THEN 3150
3120 D=INT(RND*4+1)
3130 IF D=B THEN 3120
3140 IF V(D)=0 THEN 3120
3150 K=-1
3160 ON D GOTO 3170,3200,3180,32
     10
3170 K=1
3180 F=F+K
3190 GOTO 3220
3200 K=1
3210 G=G+K
3220 IF ABS(F-P)+ABS(G-X6)>A(1,8
     )THEN 3240
3230 CALL HCHAR(F,G,106)
3240 IF (F=P)*(G=X6)THEN 3540
3250 GOTO 2460
3260 A(1,7)=A(1,7)+6
3270 FOR I=2 TO 27
3280 FOR J=2 TO 6
3290 A(I,J)=0
3300 NEXT J
3310 NEXT I
3320 M=4
3330 CALL COLOR(9,3,13)
3340 CALL COLOR(10,2,13)
3350 GOSUB 440
3360 IF H>1999 THEN 3420
3370 IF A(30,7)>6 THEN 3400
3380 A$="YOU BARELY SURVIVED."
3390 GOTO 1130
3400 A$="YOU SURVIVED"
3410 GOTO 1130
3420 A$="GREAT HUNTING"
3430 GOTO 1130
3440 A$="STARVATION AND EXPOSURE
     "
3450 FOR I=1 TO 10
3460 CALL SOUND(-1000,1200-100*I
     ,2*I)
3470 NEXT I
3480 GOTO 1130
3490 A$="DROWNED"
3500 FOR I=1 TO 20 STEP 2
3510 CALL SOUND(-100,110,I,-2,I)
3520 NEXT I
3530 GOTO 1130
3540 A$="MAULED BY BEAR"
3550 CALL SOUND(2000,760,10,-3,1
     5)
3560 GOTO 1130
3570 A(30,7)=25
3580 W=2
3590 A(30,8)=16
3600 Q=4
3610 A(1,8)=30
3620 A(1,7)=-6
3630 CALL CLEAR
3640 CALL SCREEN(4)
3650 H=1
3660 CALL COLOR(10,7,1)
3670 FOR I=2 TO 10
3680 FOR J=3 TO 27
3690 A(J,I)=0
3700 NEXT J
3710 CALL HCHAR(6,2*I+4,106)
3720 NEXT I
3730 L=7
3740 RESTORE 3920
3750 GOSUB 1340
3760 CALL HCHAR(24,31,46)
3770 CALL KEY(3,S,E)
3780 IF S=49 THEN 350
3790 IF S=50 THEN 3810
3800 IF S=51 THEN 3860 ELSE 3770
3810 A(30,8)=12
3820 A(1,8)=8
3830 A(1,7)=1
3840 W=3
3850 GOTO 350
3860 A(30,8)=8
3870 A(1,8)=4
3880 Q=2
3890 A(1,7)=7
3900 W=3
3910 GOTO 350
3920 DATA 4,7,GRISLY ADVENTURE,1
     2,4,DO YOU WANT LEVEL,14,4,
     1. HARD,16,4,2. HARDER,18,4
     ,3. HARDEST
```

Continued on p. 40

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Grisly Adventure . . . from p. 39

```
3930 DATA 22,4,MAKE SURE ALPHA L
     OCK IS UP,24,4,YOUR CHOICE?
3940 DATA 130,0,132,E07A1E07071E
     7AE0,115,10301099FFFF,116,F
     FFFFFFFFFFFFFFF,117,000020D
     30C03
3950 DATA 159,FAF0FAF0FAFEF8FF,1
     58,1F033F031F3F1F7F,157,E08
     0F0C0F0C0F8E0,156,070107010
     F030F03
3960 DATA 155,8080C080C080E080,1
     54,00000100030003,153,7E187
     E1CFE1CFF1C,152,08081C081E0
     83E18
3970 DATA 96,40E044A40E,137,0008
     081C083C183E,138,183E3C7E3C
     FE7E,150,FFFF9F1E0A80,104,8
     080808080808080
3980 DATA 105,0808080808080808,1
     06,44383810FE386C6C,107,000
     81C2A0A181414,149,000000103
     078F9FF
3990 DATA 13,16,5,11,9,5,16,4,13
     ,14,4,13,15,15,5
4000 END
```

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Wizard's Keep . . . from p. 32

1440-1550	Verb handling.
1560-1760	Moving around.
1770-1820	Get.
1830-1890	Drop.
1900-1950	Noun handling.
1960-2000	Object listing.
2010-2020	Possible command words.
2030-2090	New game.
2100-2140	Maze data.
2150	Objects, colors, and creature locations data.

```
100 REM *******************
110 REM *   ESCAPE FROM    *
120 REM *  WIZARD'S KEEP   *
130 REM *******************
140 REM
150 REM BY JACK KITCHENS
160 REM 99ER VERSION 2.12.1XB
170 RANDOMIZE
180 CALL CLEAR :: CALL SCREEN(5
    )
190 FOR I=1 TO 14 :: CALL COLOR
    (I,16,1):: NEXT I
200 DISPLAY AT(9,9):"ESCAPE FRO
    M" :: DISPLAY AT(11,8):"WIZ
    ARD'S KEEP"
210 CALL CHAR(136,"7077707E0EE
    EE0E"):: CALL HCHAR(2,3,136
    ,28):: CALL HCHAR(23,3,136,
    28)
220 CALL VCHAR(2,3,136,22):: CA
    LL VCHAR(2,30,136,22)
230 FOR DELAY=1 TO 500 :: NEXT
    DELAY :: CALL CLEAR
240 DIM N(21),S(21),E(21),W(21)
250 FOR A=1 TO 21 :: READ N(A),
    S(A),E(A),W(A):: NEXT A
260 I=0 :: FOR A=1 TO 21 :: I=I
    +N(A)+S(A)+E(A)+W(A):: NEXT
     A :: READ CC :: IF I<>CC T
    HEN PRINT "MAZE CONTAINS":"
    DATA ENTRY ERROR" :: STOP
270 R=1
280 CALL MAGNIFY(3)
290 A$="7077707E0EEEE0E"
300 CALL CHAR(116,A$):: CALL CH
    AR(124,A$):: CALL CHAR(132,
    A$):: CALL CHAR(140,A$)
310 CALL COLOR(12,16,1)
320 A$="000038E838C80D0F0703010
    1000000000000000040E0F1F9FD
    FF680800000000" :: CALL CHA
    R(136,A$)
330 FOR A=1 TO 5 :: READ NOUN$(
    A):: READ NC(A):: NEXT A ::
     FOR I=1 TO 6 :: READ RH(I)
    :: NEXT I
340 A$="00000107CF7F3F1F07030F0
    00000000000000ECAEEFCF8F0E0
    C0F0000000000" :: CALL CHAR
    (108,A$)
350 A$="1C3663410F1F787E5F591D1
    C161330001C3663C0F8FC8FBFFD
    4D5C1C34E40700" :: CALL CHA
    R(112,A$)
360 A$="000002070702031F03030F0
    8180000000000000000070D0C080
    80808080E02000" :: CALL CHA
    R(44,A$)
370 A$="00000000000E0B030101010
    101070400000040E0E040C0F8C0
    C0F01018000000" :: CALL CHA
    R(40,A$)
380 A$="0001173F0F0FEF7FFFFFFF7
    B33270F030000B0E0F080D4FCF8
    FCFFFEFCF480C0" :: CALL CHA
    R(100,A$)
390 A$="00000000001F3F70E070381
    C0E0603010000000000F8FC1E07
    0E1C387060C080" :: CALL CHA
    R(96,A$)
400 A$="0007010F1C0E070202070E1
    C0F01070000E080F03870E04040
    E07038F080E000" :: CALL CHA
    R(92,A$)
410 A$="03010101010302060404040
    404040407E04040404060203010
    101010101010F0" :: CALL CHA
    R(104,A$)
420 A$="001C764207FF919D9F88CB0
    F1B11300000386E42E0FF89B9F9
    11D3F0D8880C00" :: CALL CHA
    R(120,A$)
```

```
430 A$="0D1211202110B050F0E040A6
    9106010608003 8C13A0C0A0F070
    20508804040A0A" :: CALL CHA
    R(128,A$)
440 CALL COLOR(14,7,12)
450 FOR A=1 TO 5 :: O(A)=22 ::
    NEXT A
460 CALL CLEAR
470 FOR I=9 TO 14 :: CALL COLOR
    (I,1,1):: NEXT I
480 FOR I=2 TO 8 :: CALL COLOR(
    I,16,1):: NEXT I
490 CALL COLOR(11,16,1)
500 CALL SCREEN(5)
510 GOSUB 1040
520 GOSUB 820
530 GOTO 1350
540 REM NORTH PASSAGE
550 CALL MOTION(#1,-20,0)
560 CALL COINC(#1,#17,16,V):: I
    F V=0 THEN 560 ELSE CALL CO
    LOR(#7,1,#8,1,#9,1,#10,1,#1
    1,1,#12,1,#13,1,#14,1,#15,1
    )
570 CALL LOCATE(#1,128,121):: C
    ALL COLOR(11,16,1,12,16,1,1
    3,1,1,14,16,1)
580 CALL COINC(#1,#17,16,V):: I
    F V=0 THEN 580 ELSE CALL LO
    CATE(#1,128,121):: CALL COL
    OR(11,16,1,12,1,1,13,1,1,14
    ,1,1)
590 CALL COINC(#1,#20,8,V):: IF
     V=0 THEN 590 ELSE CALL MOT
    ION(#1,0,0):: CALL LOCATE(#
    1,65,121)
600 RETURN
610 REM SOUTH PASSAGE
620 CALL MOTION(#1,20,0)
630 CALL COINC(#1,#18,16,V):: I
    F V=0 THEN 630 ELSE CALL CO
    LOR(#7,1,#8,1,#9,1,#10,1,#1
    1,1,#12,1,#13,1,#14,1,#15,1
    )
640 CALL LOCATE(#1,1,121):: CAL
    L COLOR(11,16,1,12,16,1,13,
    1,1,14,16,1)
650 CALL COINC(#1,#18,16,V):: I
    F V=0 THEN 650 ELSE CALL LO
    CATE(#1,1,121):: CALL COLOR
    (11,16,1,12,1,1,13,1,1,14,1
    ,1)
660 CALL COINC(#1,#20,8,V):: IF
     V=0 THEN 660 ELSE CALL MOT
    ION(#1,0,0):: CALL LOCATE(#
    1,65,121)
670 RETURN
680 REM EAST PASSAGE
690 CALL MOTION(#1,0,20)
700 CALL COINC(#1,#19,16,V):: I
    F V=0 THEN 700 ELSE CALL CO
    LOR(#7,1,#8,1,#9,1,#10,1,#1
    1,1,#12,1,#13,1,#14,1,#15,1
    )
710 CALL LOCATE(#1,65,1):: CALL
     COLOR(11,16,1,12,1,1,13,16
    ,1,14,16,1)
720 CALL COINC(#1,#19,16,V):: I
    F V=0 THEN 720 ELSE CALL LO
    CATE(#1,65,1):: CALL COLOR(
    11,16,1,12,1,1,13,1,1,14,1,
    1)
730 CALL COINC(#1,#20,8,V):: IF
     V=0 THEN 730 ELSE CALL MOT
    ION(#1,0,0):: CALL LOCATE(#
    1,65,121)
740 RETURN
750 REM WEST PASSAGE
760 CALL MOTION(#1,0,-20)
770 CALL COINC(#1,#16,16,V):: I
    F V=0 THEN 770 ELSE CALL CO
    LOR(#7,1,#8,1,#9,1,#10,1,#1
    1,1,#12,1,#13,1,#14,1,#15,1
    )
780 CALL LOCATE(#1,65,241):: CA
    LL COLOR(11,16,1,12,1,1,13;
    16,1,14,16,1)
790 CALL COINC(#1,#16,16,V):: I
    F V=0 THEN 790 ELSE CALL LO
    CATE(#1,65,241):: CALL COLO
    R(11,16,1,12,1,1,13,1,1,14,
    1,1)
800 CALL COINC(#1,#20,8,V):: IF
     V=0 THEN 800 ELSE CALL MOT
    ION(#1,0,0):: CALL LOCATE(#
    1,65,121)
810 RETURN
820 REM ROOM
830 CALL COLOR(11,16,1)
840 CALL COLOR(12,1,1)
```

Continued on p. 42

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Wizard's Keep . . . from p. 41

```
 850 CALL COLOR(13,1,1)
 860 CALL COLOR(14,1,1)
 870 GOSUB 1960
 880 RETURN
 890 REM TRAPS
 900 IF R<>RH(6)THEN 950
 910 CALL SCREEN(7)
 920 CALL COLOR(#1,2)
 930 DISPLAY AT(21,7):"F I R E
       P I T"::DISPLAY AT(22,9
     ):"GAME IS OVER"::DISPLAY
      AT(23,3):"YOU HAVE BEEN BU
     RNED UP"
 940 CALL SOUND(4250,-6,1):: GOT
     O 1020
 950 CALL COLOR(11,16,1)
 960 CALL COLOR(12,1,1)
 970 -2000
 980 CALL COLOR(14,1,1)
 990 FOR I=7 TO 12 :: CALL HCHAR
     (I,1,116,2):: CALL HCHAR(I,
     31,116,2):: NEXT I
1000 FOR I=14 TO 19 :: CALL VCHA
     R(1,I,116,2):: CALL VCHAR(1
     5,I,116,6):: NEXT I
1010 DISPLAY AT(22,5):"GAME IS O
     VER YOU ARE":: DISPLAY AT(
     23,3):"STUCK IN A DOORLESS
     ROOM"
1020 CALL SOUND(1000,110,0):: CA
     LL SOUND(200,123,0):: CALL
     SOUND(600,131,0):: CALL SOU
     ND(2000,110,0)
1030 GOTO 2030
1040 CC=1 :: REM SETUP ROUTINE
1050 CALL SPRITE(#1,40,16,65,121
     ,0,0)
1060 CALL SPRITE(#2,96,NC(1),145
     ,25,0,0,#7,96,CC,17,161,0,0
     )
1070 CALL SPRITE(#3,100,NC(2),14
     5,49,0,0,#8,100,CC,17,185,0
     ,0)
1080 CALL SPRITE(#4,92,NC(3),145
     ,73,0,0,#9,92,CC,17,217,0,0
     )
1090 CALL SPRITE(#6,104,NC(5),12
     9,41,0,0,#11,104,CC,33,25,0
     ,0)
1100 CALL SPRITE(#5,108,NC(4),12
     9,65,0,0,#10,108,CC,33,49,0
     ,0)
1110 CALL SPRITE(#12,112,CC,49,3
     3,0,0)
1120 CALL SPRITE(#13,120,CC,49,1
     93,0,0)
1130 CALL SPRITE(#14,128,CC,89,6
     5,0,0)
1140 CALL SPRITE(#15,136,CC,89,1
     77,0,0)
1150 CALL SPRITE(#16,88,CC,65,1,
     0,0)
1160 CALL SPRITE(#17,88,CC,1,121
     ,0,0)
1170 CALL SPRITE(#18,88,CC,137,1
     21,0,0)
1180 CALL SPRITE(#19,88,CC,65,24
     1,0,0)
1190 CALL SPRITE(#20,88,CC,65,12
     1,0,0)
1200 CALL HCHAR(1,1,116,640)
1210 FOR I=17 TO 20 :: CALL HCHA
     R(I,4,32,8):: NEXT I
1220 FOR I=3 TO 14 :: CALL HCHAR
     (I,3,140,28):: NEXT I
1230 FOR I=7 TO 12 :: CALL HCHAR
     (I,1,124,32):: NEXT I
1240 FOR I=1 TO 20 :: CALL HCHAR
     (I,14,132,6):: NEXT I
1250 FOR I=7 TO 12 :: CALL HCHAR
     (I,14,32,6):: NEXT I
1260 RETURN
1270 REM MAGIC ROOM
1280 CALL SOUND(200,-5,0):: CALL
      COLOR(11,11,1):: DISPLAY A
     T(21,1):"YOU'RE IN THE MAGI
     C ROOM"
1290 RETURN
1300 REM FREEDOM
1310 CALL SOUND(200,-5,0):: CALL
      COLOR(11,1,1):: CALL SCREE
     N(13):: DISPLAY AT(3,7):"CO
     NGRATULATIONS"
1320 DISPLAY AT(12,7):"Y O U   H
      A V E":: DISPLAY AT(14,8)
     :"E S C A P E D"
1330 CALL SOUND(100,196,1):: CAL
     L SOUND(100,262,1):: CALL S
     OUND(100,392,1):: CALL SOUN
     D(300,523,1):: CALL SOUND(5
     0,440,1)
```

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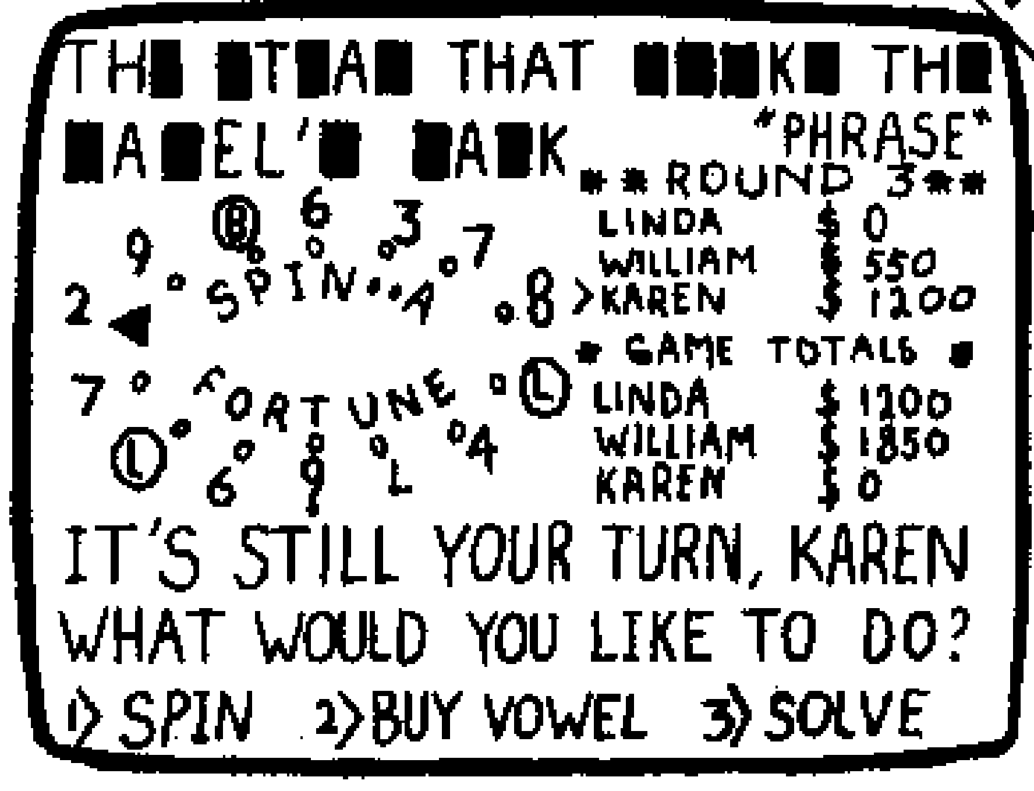

TH■ ■T■A■ THAT ■■■K■ TH■ ■A■EL'■ ■A■K

"PHRASE"
** ROUND 3**
LINDA $ 0
WILLIAM $ 550
>KAREN $ 1200
* GAME TOTALS *
LINDA $ 1200
WILLIAM $ 1850
KAREN $ 0
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Wizard's Keep

```
1340 CALL SOUND(500,523,1):: GOT
     O 2040
1350 REM SENTENCE SPLITTING
1360 NN$,VB$=" " :: DISPLAY AT(23
     ,1):"COMMAND ? " :: ACCEPT
     AT(23,11):A$
1370 FOR I=21 TO 24 :: CALL HCHA
     R(I,3,32,28):: NEXT I
1380 FOR A=1 TO LEN(A$)
1390 IF SEG$(A$,A,1)=" " THEN X=
     A-1 :: A=0 :: GOTO 1420
1400 NEXT A
1410 VB$=A$ :: GOTO 1460
1420 VB$=SEG$(A$,1,X)
1430 NN$=SEG$(A$,X+2,LEN(A$)-X-1
     )
1440 REM VERB HANDLING
1450 IF VB$="GO" THEN VB$=NN$
1460 IF VB$="NORTH" OR VB$="SOUT
     H" OR VB$="EAST" OR VB$="WE
     ST" OR VB$="N" OR VB$="S" O
     R VB$="E" OR VB$="W" THEN 1
     560
1470 IF VB$="GET" OR VB$="TAKE"
     THEN 1770
1480 IF VB$="DROP" OR VB$="LEAVE
     " THEN 1830
1490 IF VB$="Q" OR VB$="QUIT" TH
     EN CALL CLEAR :: STOP
1500 IF VB$<>"SAY" THEN 1550
1510 IF R<>21 THEN DISPLAY AT(21
     ,1):"THIS ROOM NOT MAGIC" :
     : GOTO 1360
1520 IF O(3)<>22 THEN DISPLAY AT
     (22,1):"NO MAGIC CHARM PRES
     ENT"
1530 IF NN$<>"ROCK" THEN DISPLAY
      AT(21,1):"WRONG MAGIC WORD
     "
1540 IF NN$="ROCK" AND O(3)=22 T
     HEN 1300 ELSE R=1 :: GOSUB
     2070 :: GOTO 1360
1550 DISPLAY AT(22,1):"I DON'T K
     NOW HOW TO ";VB$ :: GOTO 13
     60
1560 REM MOVING AROUND
1570 CALL SOUND(50,1245,3)
1580 VV$=SEG$(VB$,1,1):: IF VV$=
     "N" OR VV$="W" THEN CALL PA
     TTERN(#1,44)ELSE CALL PATTE
     RN(#1,40)
1590 IF VB$="N" OR VB$="NORTH" T
     HEN X,R=N(R):: GOSUB 540
1600 IF VB$="S" OR VB$="SOUTH" T
     HEN X,R=S(R):: GOSUB 610
1610 IF VB$="E" OR VB$="EAST" TH
     EN X,R=E(R):: GOSUB 680
1620 IF VB$="W" OR VB$="WEST" TH
     EN X,R=W(R):: GOSUB 750
1630 I=INT(RND*4)+1 :: IF I=1 TH
     EN A$="EAST" ELSE IF I=2 TH
     EN A$="WEST" ELSE IF I=3 TH
     EN A$="SOUTH" ELSE A$="NORT
     H"
1640 IF R=RH(1)THEN CALL COLOR(#
     12,10):: DISPLAY AT(21,1):"
     A FIRE BEAST SAYS" :: DISPL
     AY AT(22,1):"GO ";A$
```

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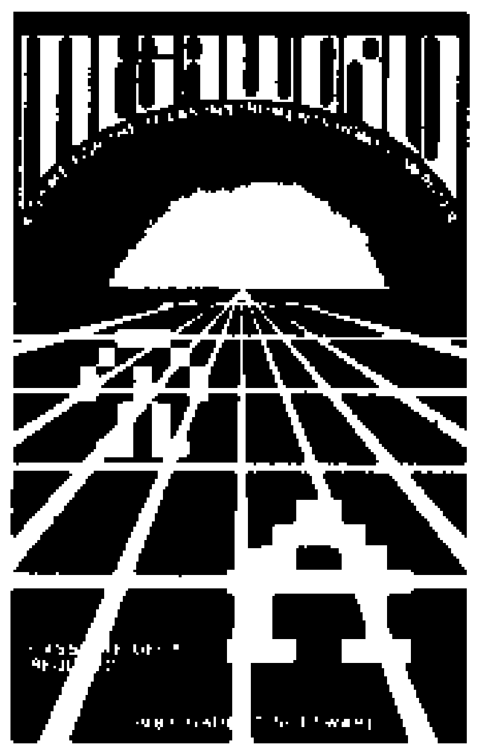
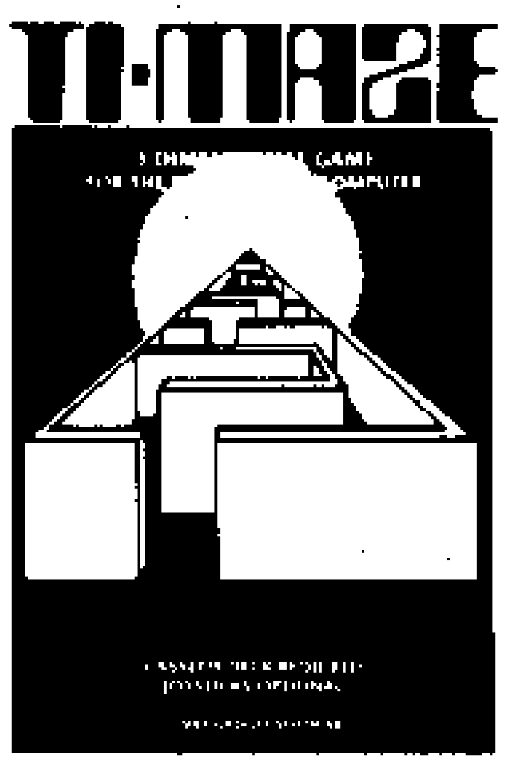
```
1650 IF R=RH(2)THEN CALL COLOR(#
     13,2):: DISPLAY AT(21,1):"A
      TROGLODYTE SAYS" :: DISPLA
     Y AT(22,1):"GO ";A$
1660 IF R=RH(3)THEN CALL COLOR(#
     15,12):: DISPLAY AT(21,1):"
     A DRAGON SAYS" :: DISPLAY A
     T(22,1):"THE FIRE PIT IS ";
     A$
1670 IF R=RH(4)THEN CALL COLOR(#
     14,16):: DISPLAY AT(21,1):"
     A WISP SPIDER SAYS" :: DISP
     LAY AT(22,1):"DON'T GO ";A$
1680 IF R=RH(5)THEN 890
1690 IF R=RH(6)THEN 890
1700 IF R=21 THEN GOSUB 1270 ::
     GOTO 1720
1710 GOSUB 820
1720 X=R
1730 GOSUB 1960
1740 X=0
1750 CALL SOUND(50,988,3):: CALL
      SOUND(50,988,3)
1760 GOTO 1360
1770 REM GET ROUTINE
1780 GOSUB 1900
1790 IF O(X)=R OR O(X)=22 THEN 1
     810
1800 GOTO 1820
1810 O(X)=22 :: XA=X+1 :: XB=X+6
      :: CALL COLOR(#XA,NC(X),#X
     B,1)
1820 X,XA,XB=0 :: GOTO 1360
1830 REM DROP ROUTINE
1840 PX=0 :: GOSUB 1900 :: IF PX
     =1 THEN PX=0 :: GOTO 1360
1850 IF O(X)=22 THEN 1870
1860 GOTO 1890
1870 O(X)=R :: XA=X+1 :: XB=X+6
1880 CALL COLOR(#XA,1,#XB,NC(X))
1890 GOTO 1360
1900 REM NOUN HANDLING
1910 FOR A=1 TO 5
1920 IF NN$=NOUN$(A)AND(O(A)=R)+
     (O(A)=22)THEN X=A :: A=0 ::
      CALL SOUND(-200,660,1):: C
     ALL SOUND(-200,440,1):: RET
     URN
1930 NEXT A
1940 DISPLAY AT(21,1):"I DON'T S
     EE THE ":NN$
1950 PX=1 :: RETURN
1960 REM LISTING ROUTINE
1970 FOR A=1 TO 5 :: Y=A+6
1980 IF X=O(A)THEN CALL COLOR(#Y
     ,NC(A))ELSE CALL COLOR(#Y,1
     )
1990 NEXT A
2000 A,Y=0 :: RETURN
2010 PRINT "The words I recogniz
     e are:":" ":"DROP GET LEAVE
      TAKE GO QUIT SAY NORTH SOU
     TH EAST WEST"
2020 PRINT "GEM AMULET ROCK BOTT
     LE LAMP":" ":"  [AND SOME A
     BBREVIATIONS]"
2030 REM NEW GAME
```

Continued on p. 73





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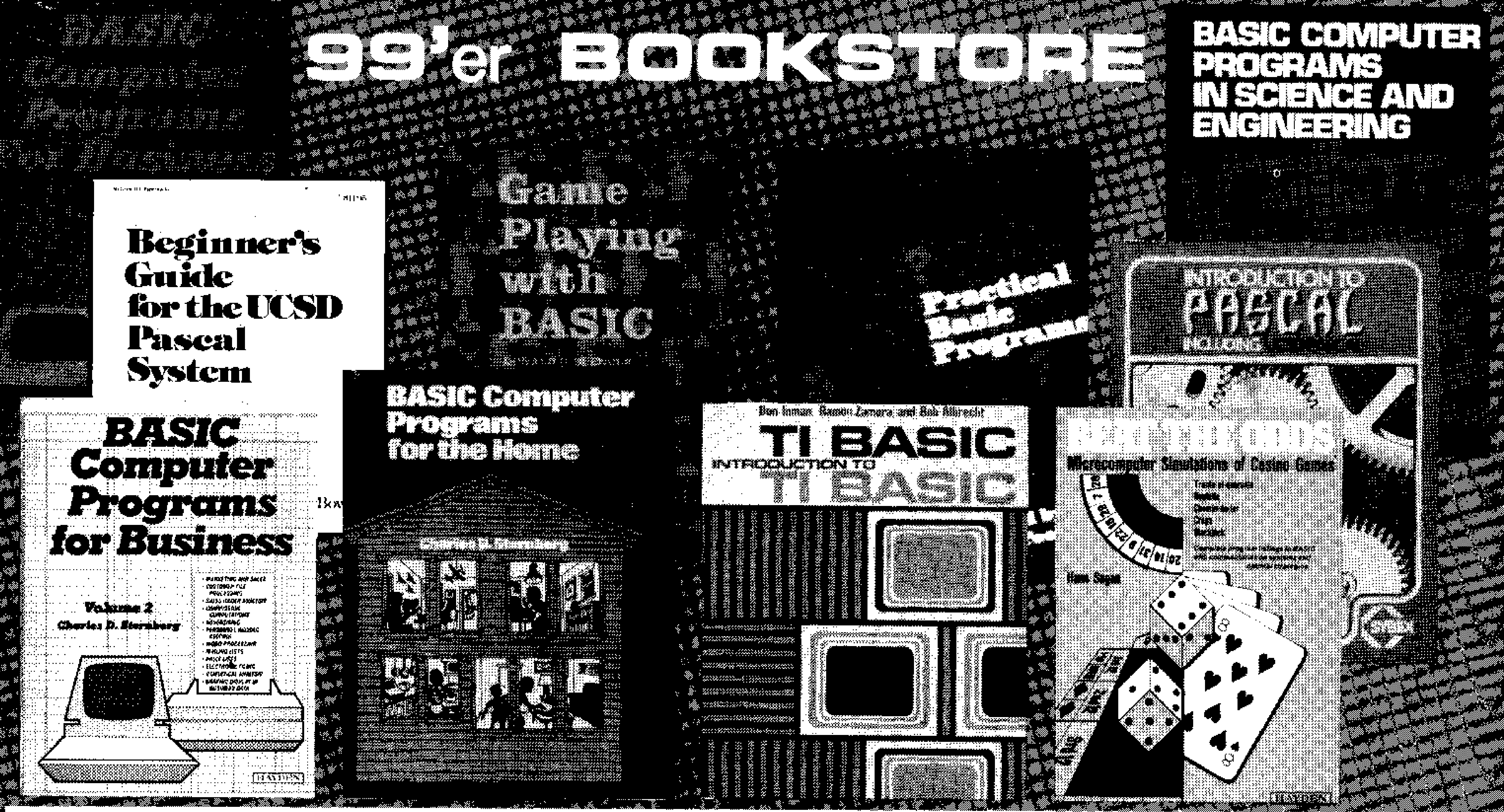
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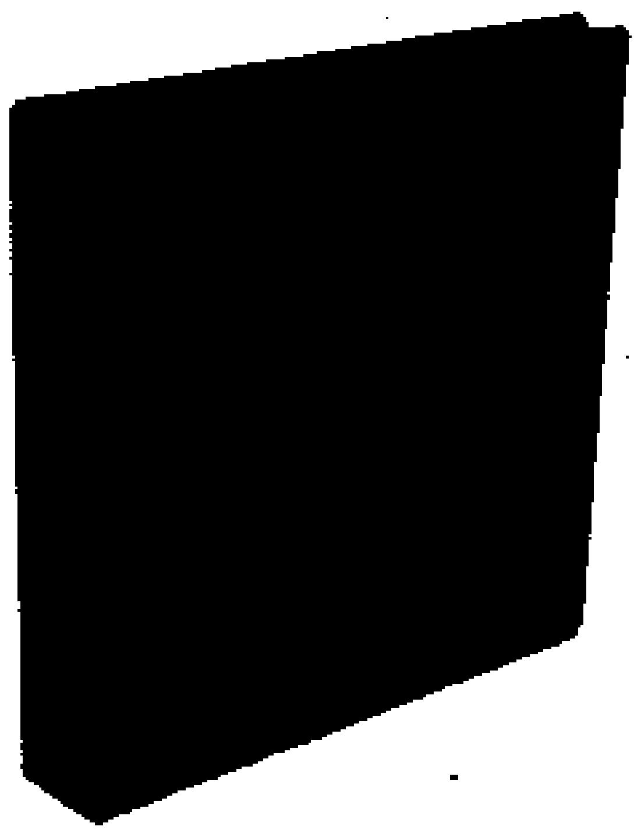

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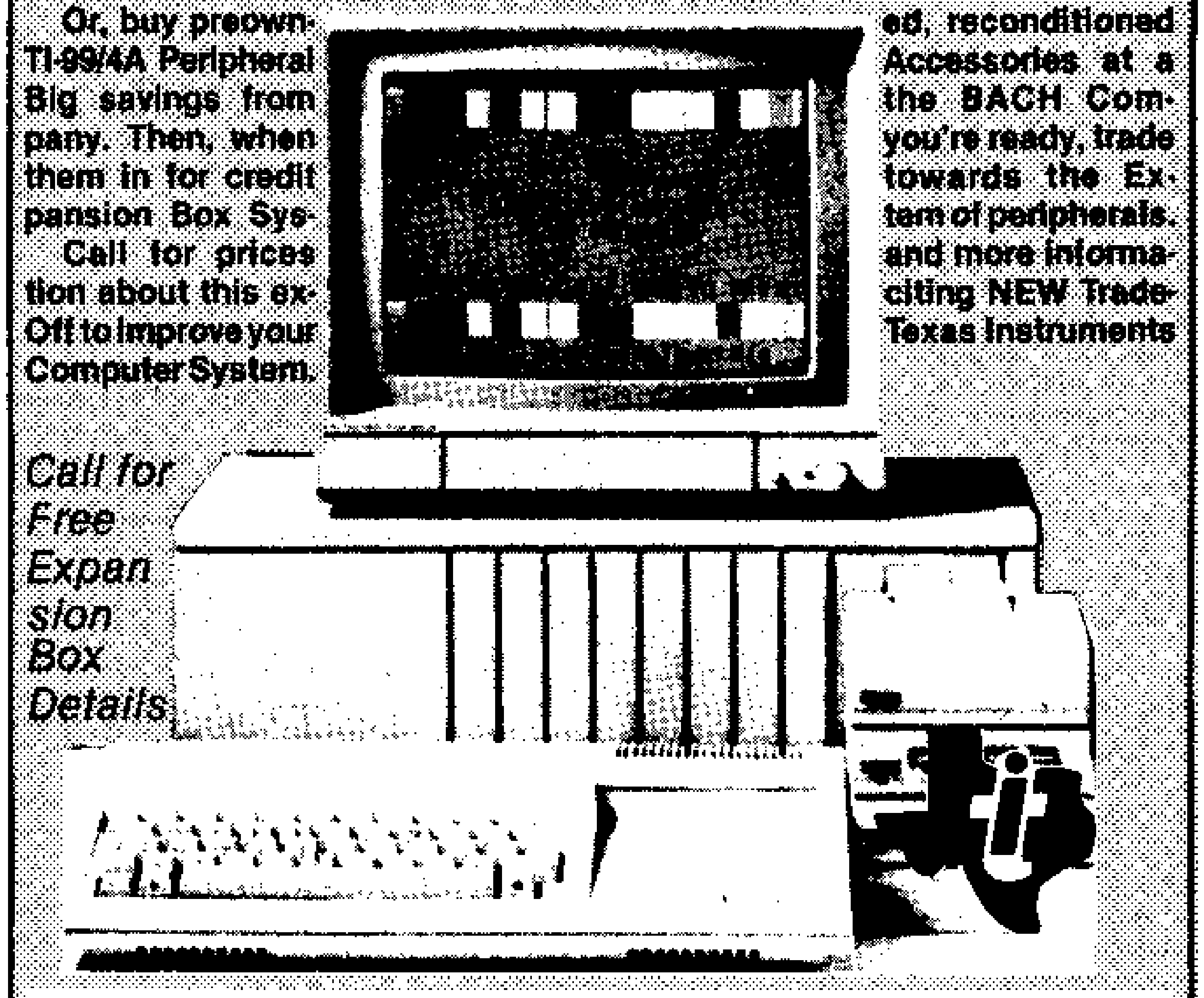

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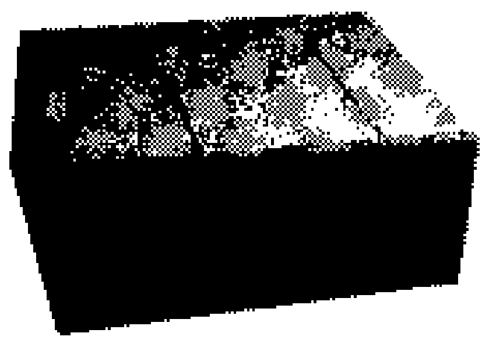

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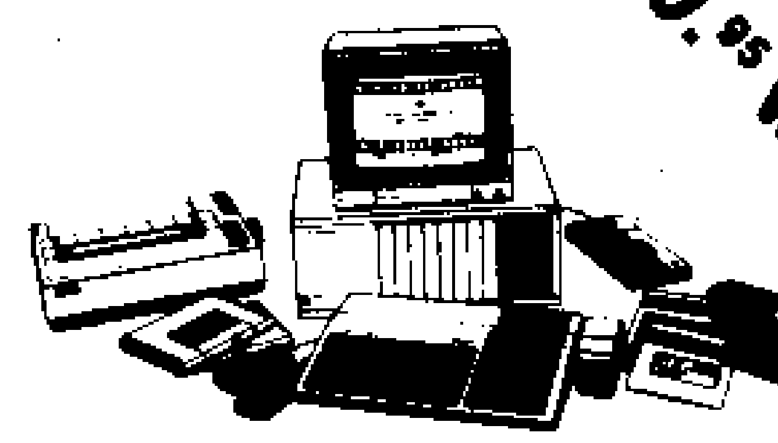

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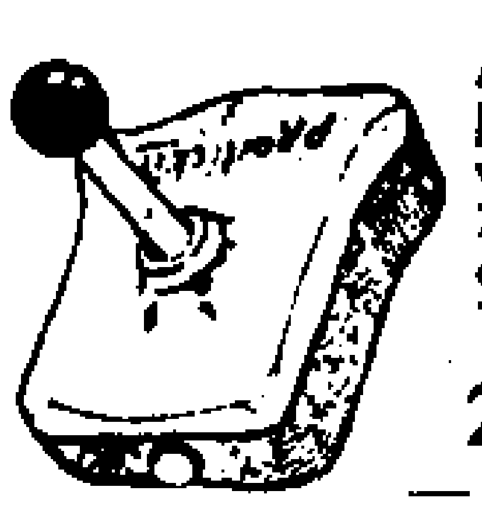

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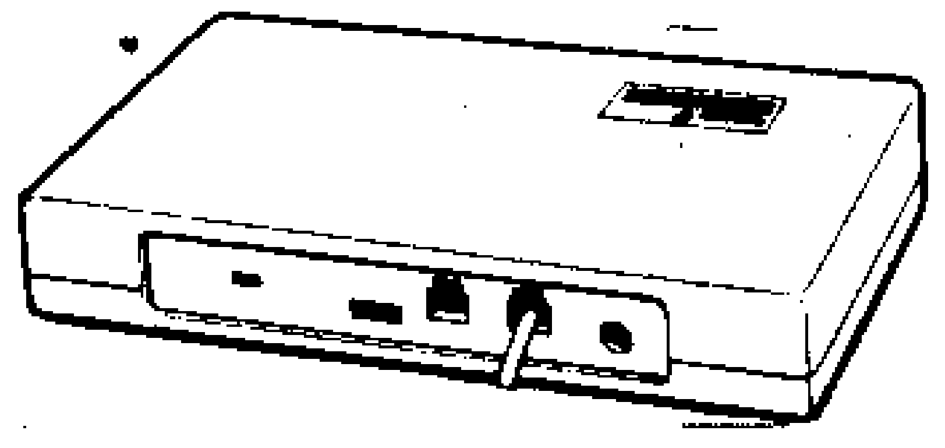

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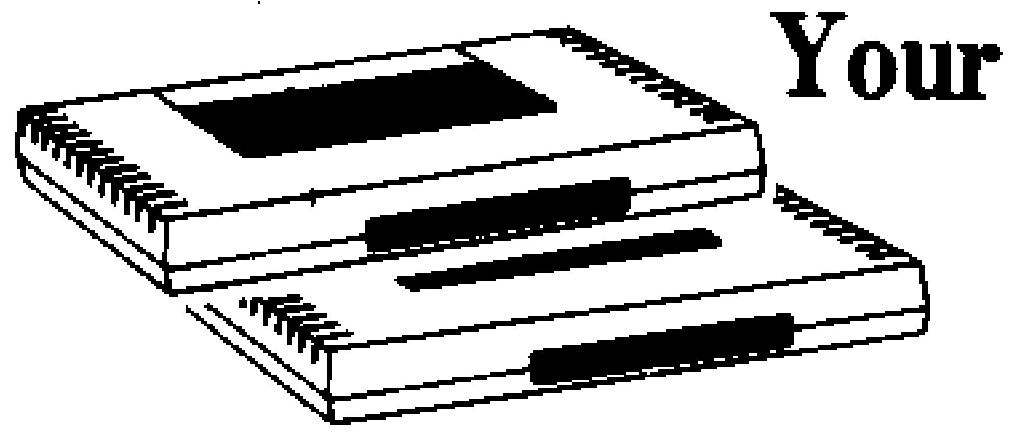

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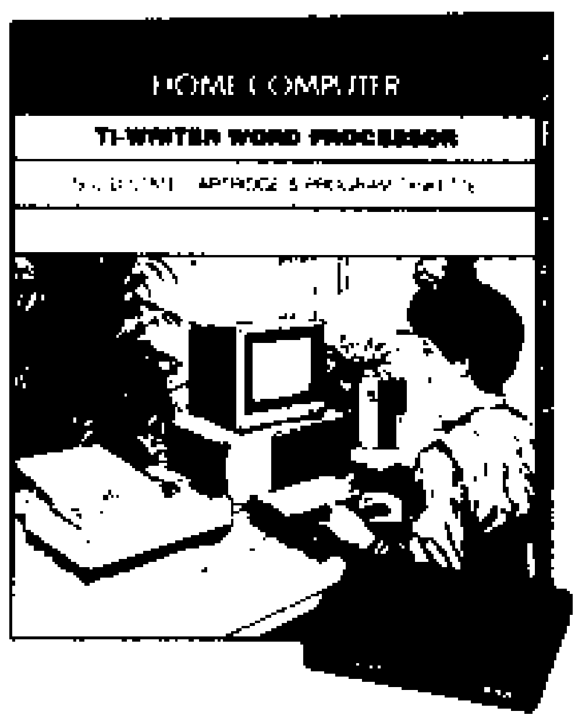

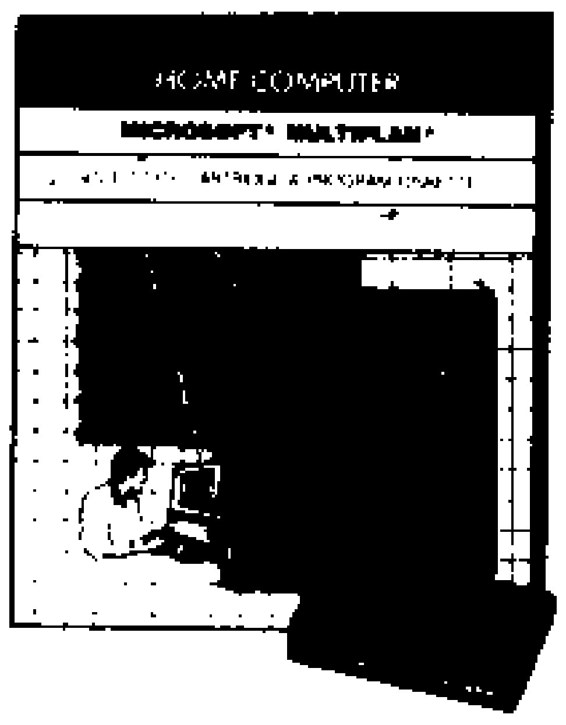

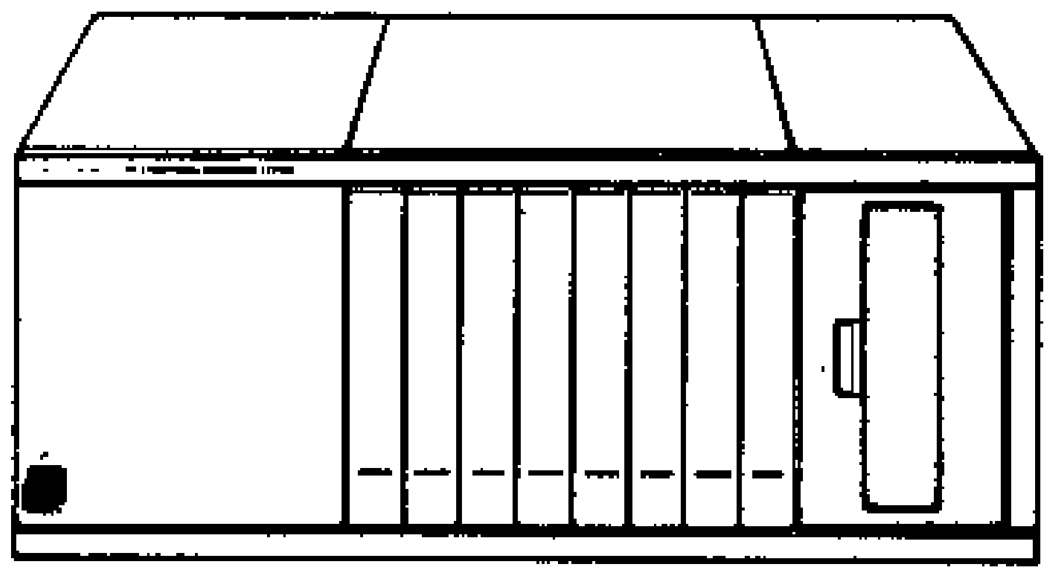

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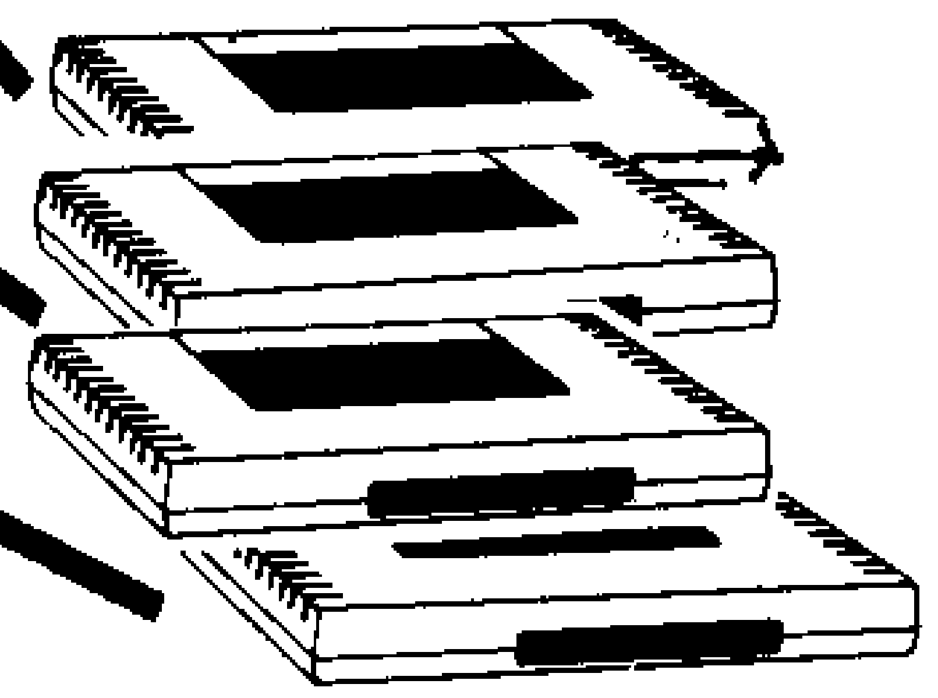

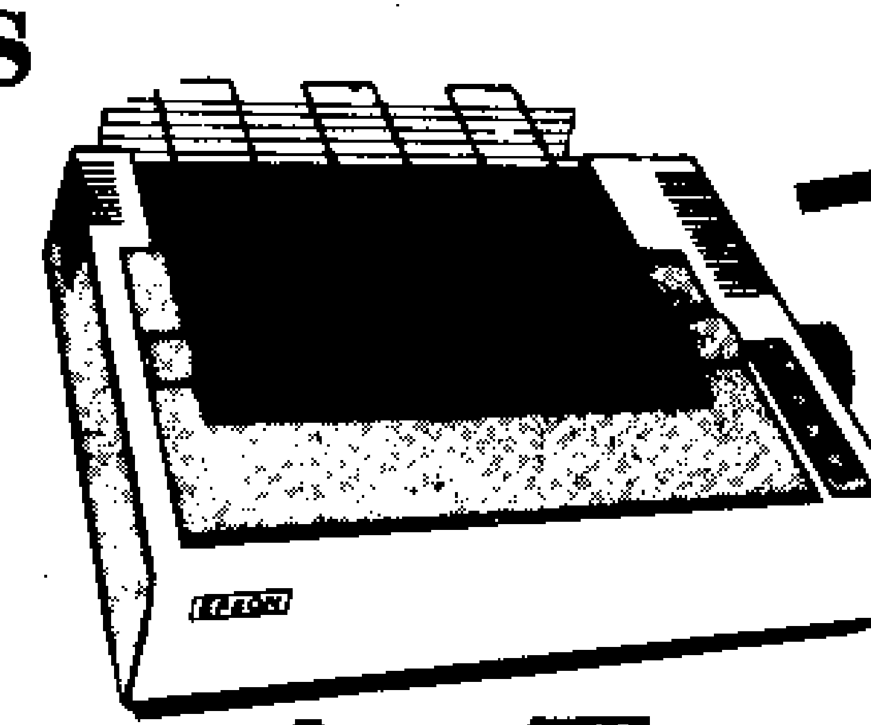

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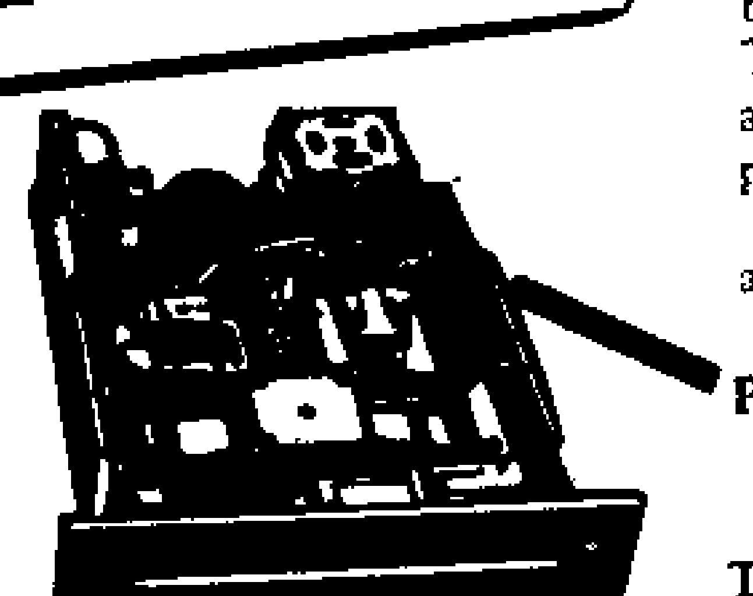

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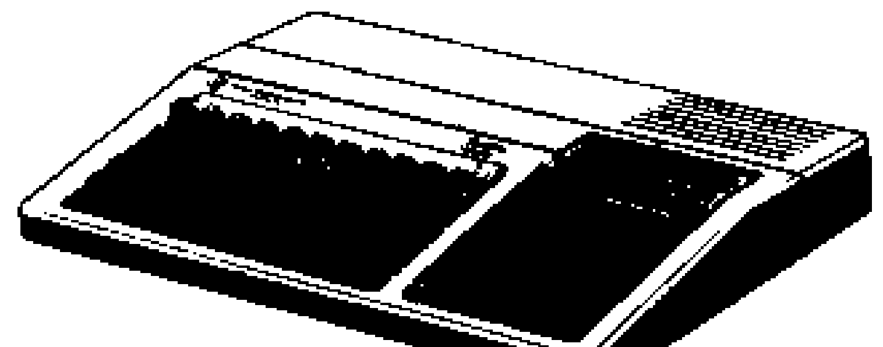

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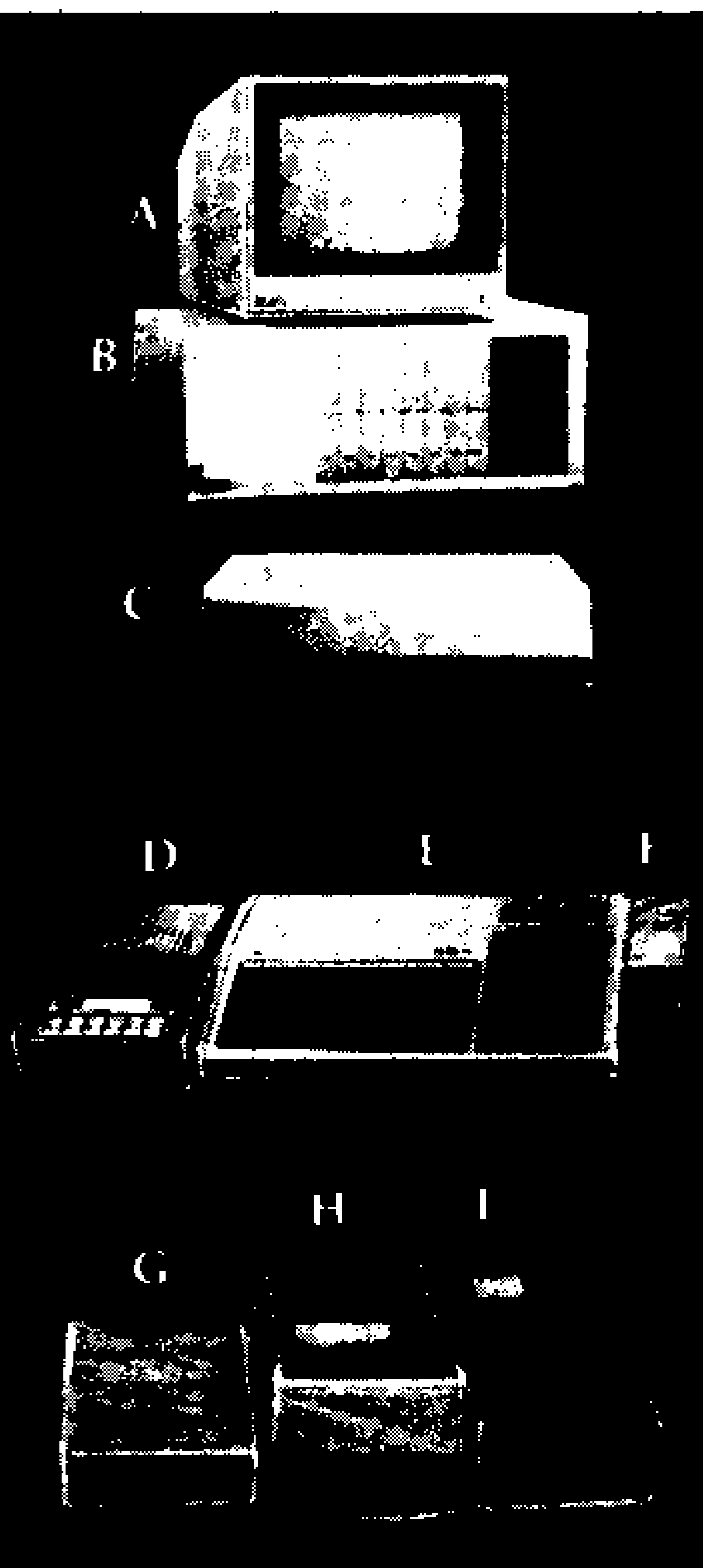

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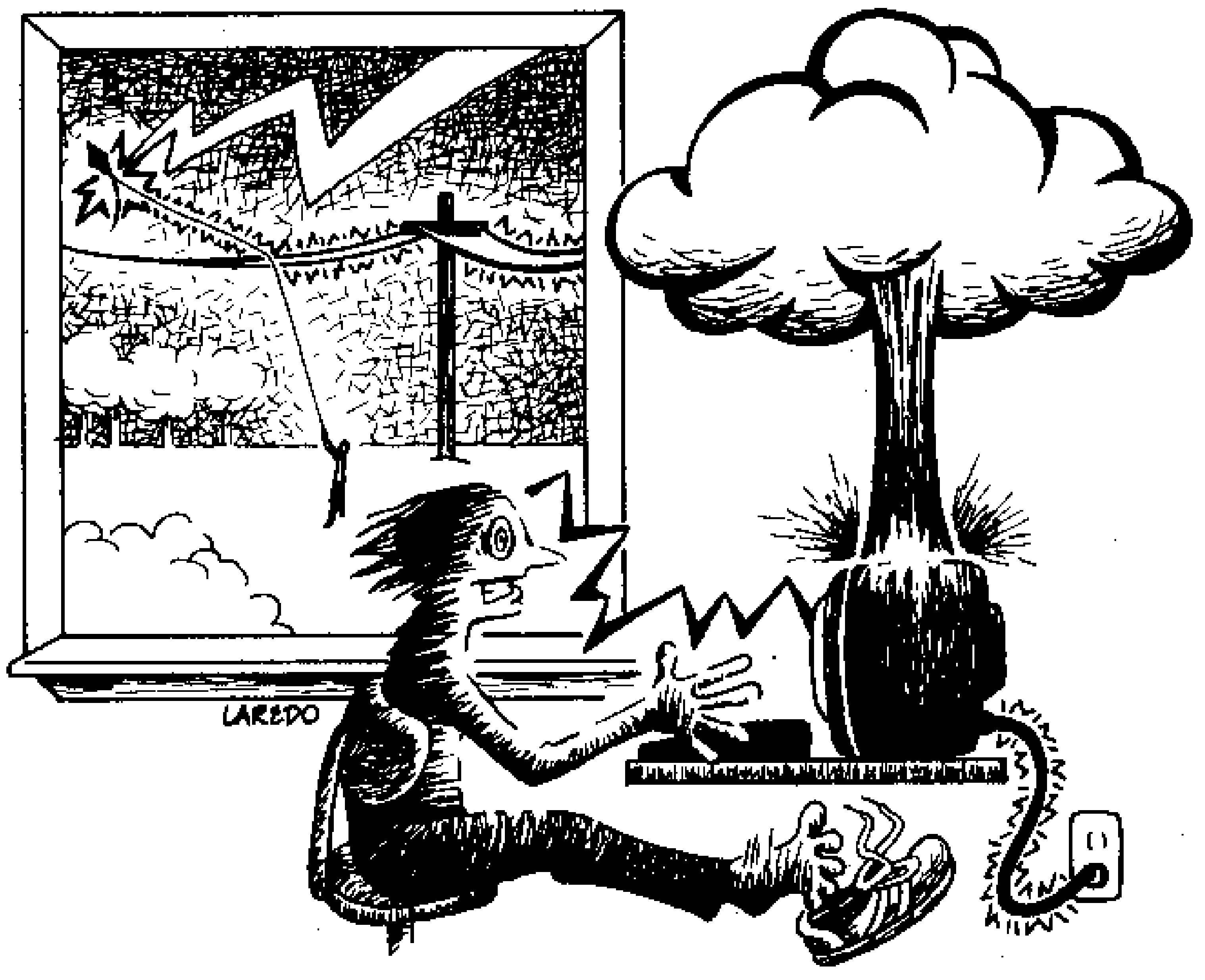
This month's vintage article, which has been updated and expanded, originally appeared in Volume 1, Number 1 of *99'er HCM*. So, return with us to . . .

Power Line Problems in Personal Computers

By G. R. Michaels



Athough glitches, crashes, errors, false printouts, memory loss, and other forms of erratic microcomputer operation are usually blamed on software and hardware, most of these annoying problems actually come to you courtesy of your ordinary 120-volt powerline! These problems are directly traceable to three general causes: (1) processor-memory-peripheral interaction, (2) power line noise/hash, and (3) transient voltage surges. Fortunately, serious computer users don't have to live with these problems, because many types of corrective devices are available.

Powerline Coupling

The fact that microcomputer systems are so easy to hook up—just plug the computer and peripherals into the wall socket, and connnect the components with a few convenient male/female preassembled cables—makes them susceptible to power line noise. Connecting them to powerline strips that are integrated with RFI (radio-frequency interference) filters will effectively isolate the computer and peripherals from each other and from the power line—thus providing a convenient solution to the problem.

Hash

Hash is another problem altogether. When your favorite space-war game gets fouled up by "glitches," or your previously-proven-to-be-faultless program "blows up" or creates erroneous printout, externally created hash is the probable cause. Elimination of hash at the source is the most desirable solution. But with hundreds of potential sources (arcing in tools, motors, appliances, and other small electrical devices, plus loose, defective, or corroded light sockets, wall sockets, line-cord plugs, or wire connections), pinpointing the offender is often most difficult. That's where hash filters are most effective. They often can completely eliminate the interference.

An alternate approach to the hash problem is first to make certain that all equipment covers and shields supplied by the manufacturer are securely fastened in place. If that doesn't work, you might try building and installing your own shield. Also don't forget to make sure that you have an adequate grounding system with *direct ties* to a good ground rather than *ground loops* (which often provide a home for system hum that can induce glitches).

Transient Voltage Surges.

Transient voltage surges (transients) are certainly not friends of microcomputer circuitry. Semiconductor components are easily damaged by these momentary spikes—often 5 or 10 times the normal AC line voltage. And industry studies indicate that some transients have pulses up to 5,600 volts!

Common causes of destructive powerline transients include (1) demand power load switching by utility companies, (2) nearby lightning strikes, (3) static discharge, and (4) on/off switching of inductive motors, power supplies, air conditioning and refrigeration units. Any of these can cause a Differential Mode powerline surge—one in which short surges of extremely high voltage are developed *between* the AC lines. Anything connected to the AC lines will get a dose of this damaging voltage. The resulting "domino effect" could wipe out large sections of microcomputer memory.

A Common Mode surge occurs when *both* AC lines are brought to a very high voltage—a situation usually caused only by lightning. This high voltage may cause arcing between conductors and ground, destroying the insulation of power transformers (rendering the units worthless) and cables. Damage to switches and controls is also a frequent occurrence in this situation.

Besides the surge damages that are immediate and permanent, there are some harder-to-detect damages as well: deteriorated performance and shortened life-spans. These damages can be the most irritating since equipment will require repeated servicing and will often seem to be falling apart.

Fortunately, a large measure of surge protection is possible with clamping devices that can be placed across the AC line and between each AC line and ground. These devices are frequently built into special AC line cords, and thus, like the other protective devices mentioned, can be attached without altering any equipment. 99'er

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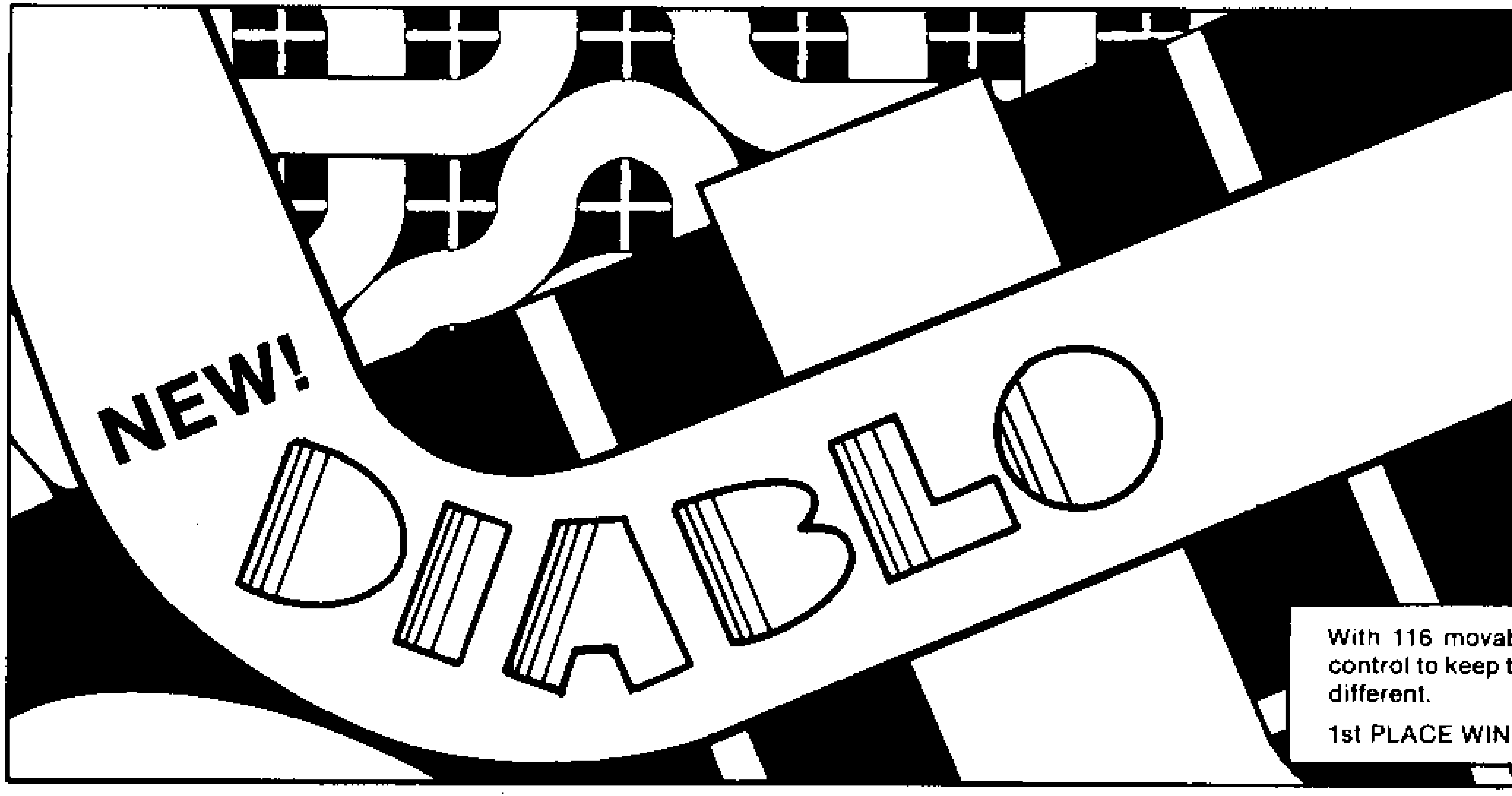

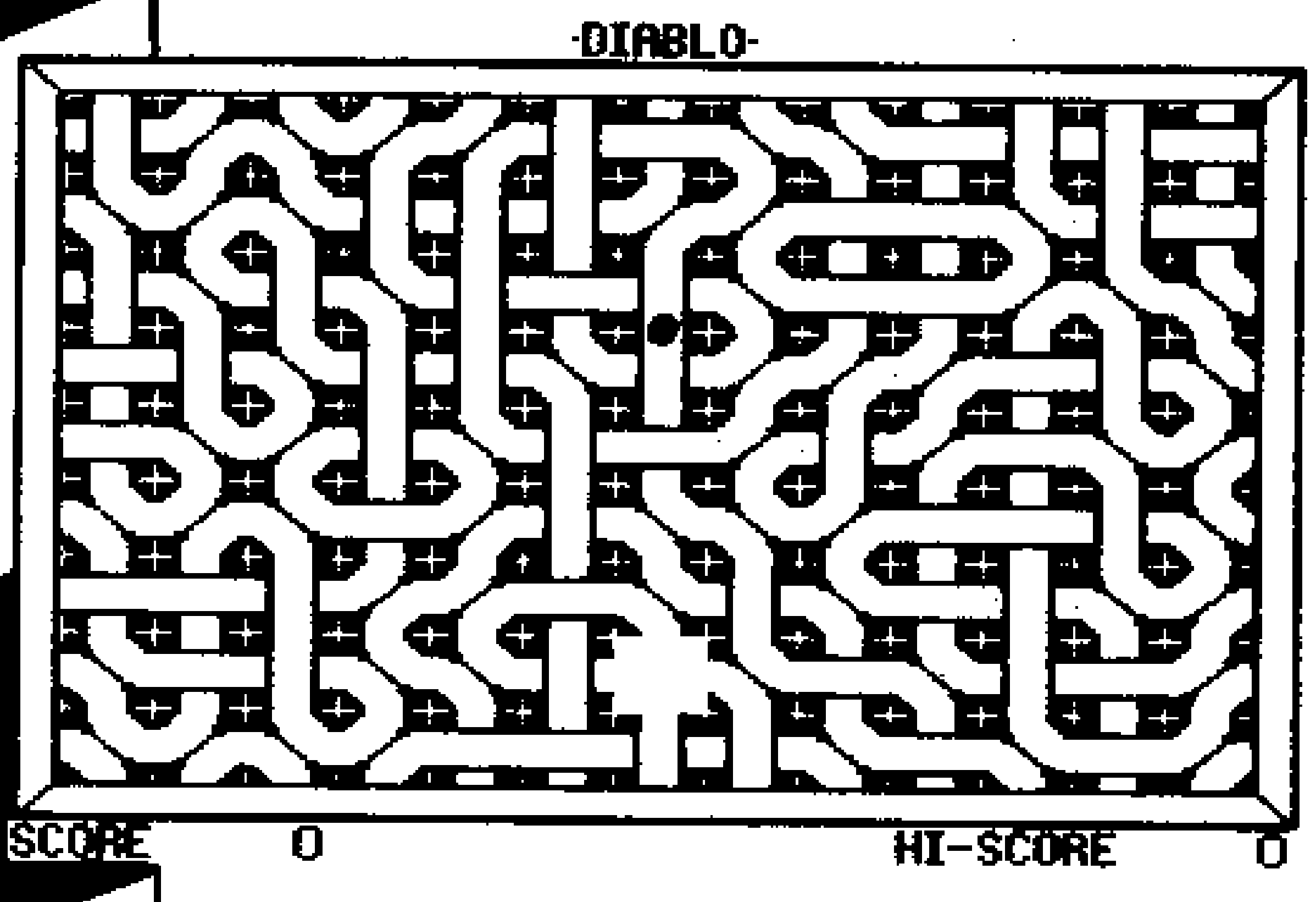

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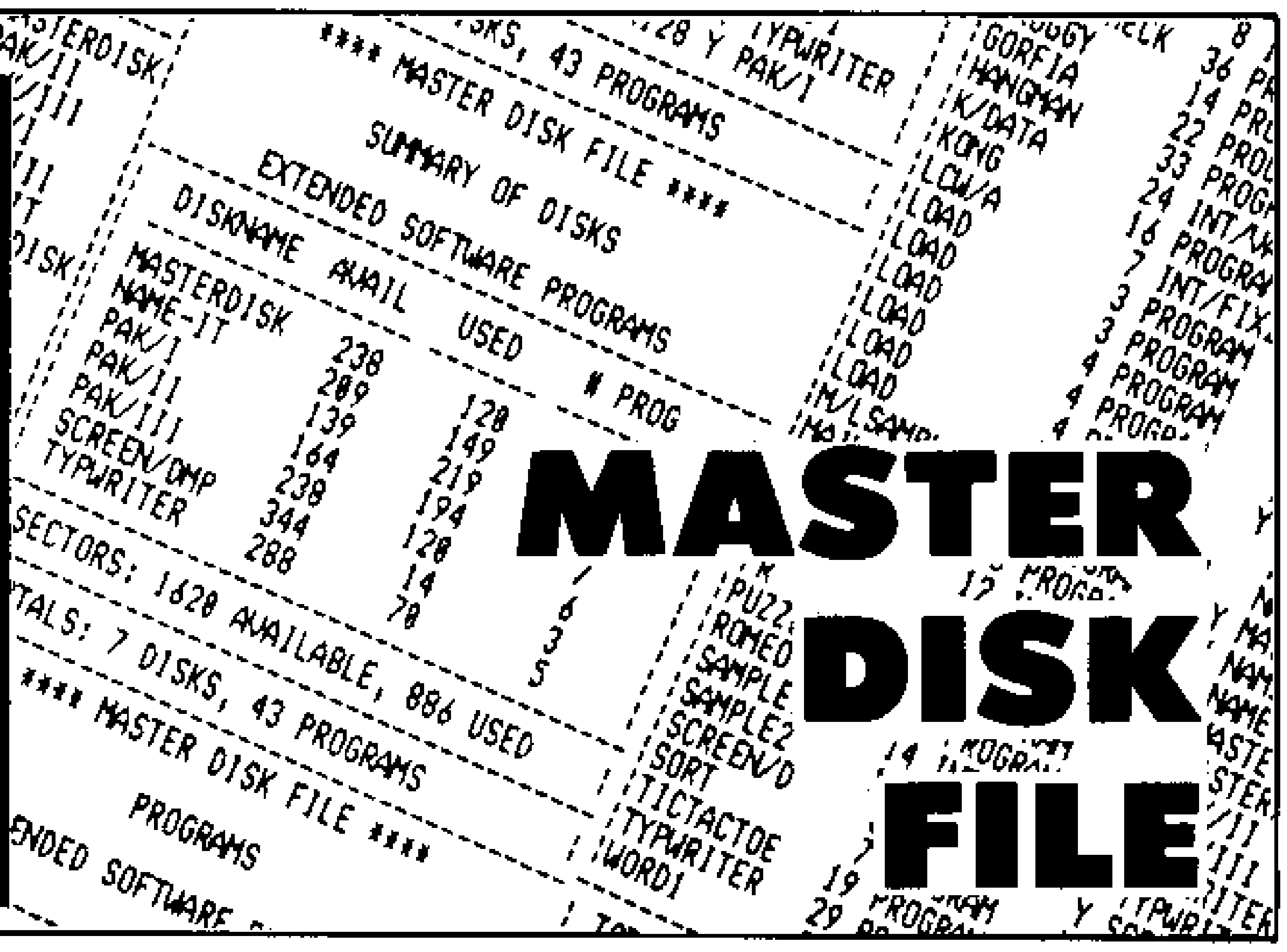

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ZOMBIE . . . from p. 29

Cantankerous Cadavers

There are two separate games in *Zombie Mambo.* Part 1 begins in the graveyard, a garish pink and green garden with a crypt reminiscent of the Taj Mahal in the background. Your assignment is to dig through the graves in search of three golden keys that will gain you access to the sorcerer's crypt. As you dig, you will hear the realistic crunch of the shovel (and see a growing mound of dirt) each time you hit the fire button.

The sound effects are, as a matter of fact, my favorite feature in *Zombie Mambo.* Muffled, echoing footsteps evoke the feeling of the empty tomb. A door clangs shut to signal your entrance into the crypt. Best of all is the sound of the zombies themselves—a strange cacophony of unearthly grunts, pig-like oinks, and, of course, the constant, dragging footsteps. There is also a syncopated, DEVO-esque tune (the mambo?) which serves as a nice counterpoint to the zombie grunts.

Once you have dug eight scoops of dirt, either a key, weapon or zombie will appear. If it's a weapon or key, hang on to it. Most likely though, it will be a zombie. The stumbling stiff will raise himself from his not-so-final resting place and begin stalking you. The zombie (and also your own character) can move either quickly or slowly, depending on the level of difficulty (1-9) you choose at the beginning of the game. This type of adjustable difficulty level is generally a good option to provide; it ensures that the game will remain challenging as you reach higher levels of proficiency. In the case of *Zombie Mambo*, however, I'm not sure it is really necessary. Part 1 was too difficult for us, even on level 9 (the easiest level). We played it all afternoon and never made it to the crypt. In fact, I was so frustrated after losing nine rounds in a row that I wanted a Zombie—the kind with rum in it!

Dead on Your Feet

Part of the problem may have been our limited mobility. It is impossible to move diagonally or turn about-face. To go from facing north to south, you must first make a quarter-turn. (Of course the zombies are similarly hampered.) Also, in Part 1, you are hemmed in by the walls of the graveyard. There is, however, one point in your favor: The zombies kill one another on contact. So if you are cornered, you can simply hover above the meandering mummies (they usually move in horizontal paths) and wait for one to "re-kill" his brother. Also, the zombies can stalk only while you are active. . . but remember they *can* attack while you are digging. So don't let down your guard when you pick up the shovel!

There are only three keys hidden in the cemetery, so your grave/gold-digger may have to rifle through every plot before finding them. You will usually also find a weapon which kills only one type of monster. We tried this "weapon" twice and it never worked. Instead, we got the message "Your weapon is ineffective." Even though we are warned in the manual that this might happen, it is frustrating to lose the game every time your weapon fails. It would have been less devastating to deduct a sum from our cash pile when our gun "missed." As it was, we decided gambling on the weapon wasn't worth the risk.

Let's Make a Deal

Once you gather all three keys, you can enter. . . the crypt. This is the really engrossing part of the game. To start Part 2 you must reload the tape. Be sure to read the loading instructions or you might, as I did, flip the cassette before loading it. Part 2 offers the game's more cerebral challenge. You must find your way out of the labyrinthine tomb. On the way, you progress through several chambers (on separate screens), opening vaults to reveal either valuable cash prizes (yea!) or stalking monsters (boo). A different type of monster resides in each chamber. You can enter and exit these rooms freely, but if your re-enter a room with monsters in it, you will be killed instantly. You must discover a complex, secret pattern in order to escape the tomb. The documentation recommends making a map to keep track of money, weapons and monsters as you explore the chambers. I would take this "recommendation" as an order. And even with a map, solving this maze will test your logic, patience and visual memory to the fullest.

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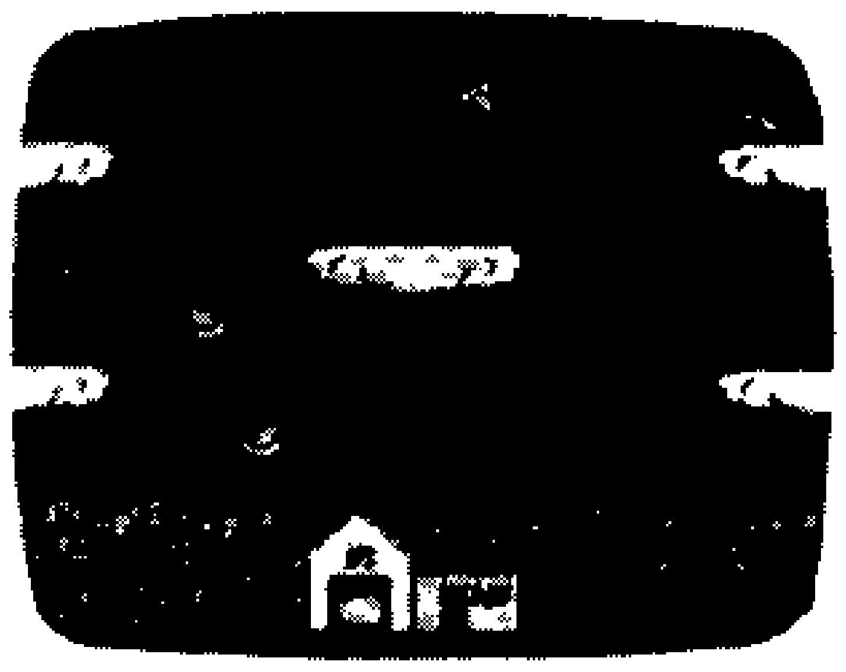

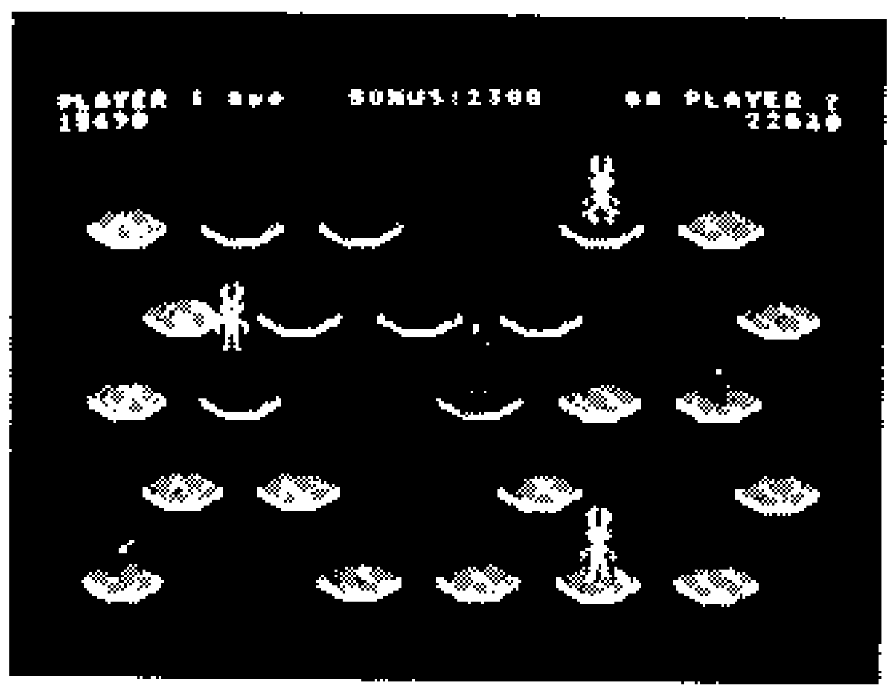

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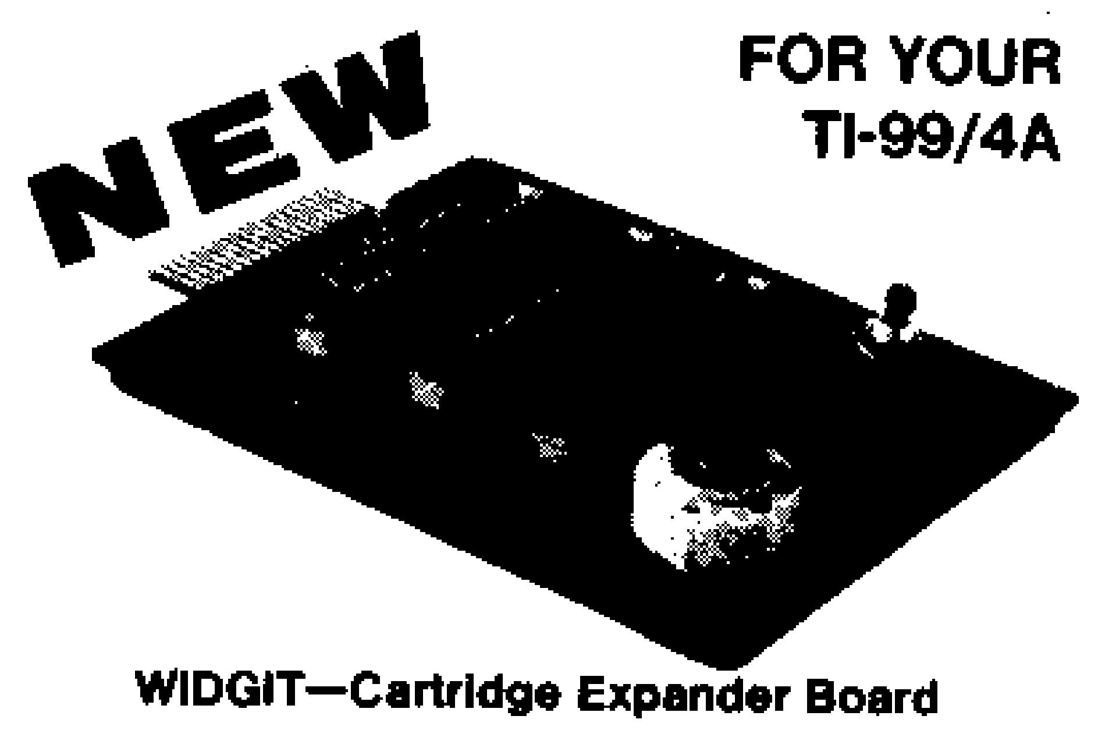

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This program requires EDITOR ASSEMBLER, 32K memory expansion and a Disk drive.

Catalog number: AS-01 on diskette only

PRICE: $29.95 ea.

Gruesome Graphics

Zombie Mambo's graphics may not be spectacular, but they are unusual. The pale, grey zombies do look like dead shadows of former selves. Unfortunately, the piles of earth you dig from the grave are the same shade of grey, so the zombies and dirt piles tend to blend together. I'd prefer some rich "earth tones" for the unearthed debris. In Part 2, the tomb's monsters are imaginative, if somewhat odd. One resembles a pot-bellied woodstove, another a Hawaiian tiki god. I thought the graphics were OK, but I have one suggestion. It would be helpful (at least for those who have no adventure gaming experience) to somehow distinguish the tomb's chambers from one another in the initial, easy levels of the game. As it is, it's impossible to differentiate between the rooms without opening a vault—and you are immediately killed if you re-enter a room with remaining monsters! I'm not saying it can't be done; it's just a bit too much of a challenge for beginners.

Crypt-ic Documentation

The documentation is—excuse the expression—strictly "bare bones." Loading and running are adequately explained, as is how to maneuver your grave-digger. But Part 2 of the game baffled me, and the instructions offered no clues. How, I wondered, do I distinguish one room from another? Do I have to get all the money before I can exit? For those who have never played an adventure game, the modus operandi can be difficult to figure out. For these novices, a short explanation of how to find your way through the tomb would cut down on some of the frustrating trial and error. The game is certainly challenging enough without concealing how it's done. The instructions also failed to note that your disk drive must be disconnected before the program will run. It seems that many manuals fail to mention this important point.

Despite these minor flaws, I recommend *Zombie Mambo* highly, especially for those of you who are looking for a game in BASIC. Even though Part 1 proved impossible for any of us to master, Part 2 more than made up for the disappointment. It is a really tough game which will remain a challenge, both physically (dodging zombies) and mentally (navigating the tomb), long after your first foray into the crypt. There is a lot to *Zombie Mambo*—multiple screens, multiple levels of difficulty, and multiple goals. The game is also successful in conveying its scenario. The clanging door of the tomb, echoing footsteps, unearthly grunts, and pale, plodding figures all evoke the home of the ungrateful undead. So if Halloween has you hankering for some ghouling around, check out *Zombie Mambo*. But be forewarned—the game is Difficult. Whatever you do, don't vow to play until you win. . . or you may experience your own night of the living dead and end up feeling a lot more zombie than mambo.

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Desert Dilemma . . . from p. 10

```
610 PRINT "SATION SHE HEARD BET
    WEEN":" TWO MERCHANTS.IT SE
    EMS":" THAT SOMEONE HAS"
620 PRINT "STOLEN A LARGE DIAMO
    ND FROM":"SHEIK AMA SOHAMI
    AND THERE":"IS A REWARD OF
    10 POUNDS OF"
630 PRINT "GOLD FOR ITS RETURN.
     YOU ":"DECIDE TO INVESTIGA
    TE. DO ":"YOU WANT TO FIND
    THE MER-"
640 PRINT "CHANTS OR DO YOU WAN
    T TO GO ":"TO THE SHEIK? TY
    PE MERCHANTS":"OR SHEIK."
650 RETURN
660 DATA MERCHANTS,IN ARRIVING
    AT THE WELL YOU,DISCOVER TH
    AT THE MERCHANTS,ARE GONE.
    NO ONE SEEMS TO
670 DATA KNOW WHERE THEY WENT.
    DO YOU,WANT TO LOOK FOR THE
    M AT,THE OGAMI OASIS OR IN
    THE
680 DATA MARKET? TYPE OASIS OR
    MARKET,OOO,SHEIK,THE SHEIK
     TELLS YOU THAT HE,IS SUSPIC
    IOUS OF TWO PEOPLE
690 DATA ONE OF THEM IS HIS BRO
    THER-,IN-LAW PRINCE YOHASI.
     THE,OTHER IS HIS SERVANT G
    IRL
700 DATA SUHONI. YOU LEARN THAT
    ,YOHASI IS WORKING TODAY AT
    ,HIS JOB AT THE OIL FIELD.,
    SUHONI HAS THE DAY OFF AND
710 DATA HAS GONE SHOPPING. WHO
     DO,YOU WANT TO INVESTIGATE
    ?,YOHASI OR SUHONI,OOO,YOHA
    SI
720 DATA DO YOU REALLY THINK SO
    MEONE,WHO HAD JUST STOLEN A
     DIA-,MOND WOULD GO TO A JO
    B IN,AN OIL FIELD? WELL ITS
730 DATA POSSIBLE. AT ANY RATE
    DO YOU,WANT TO GO STRAIGHT
    TO,YOHASI AT WORK OR DO YOU
    ,WANT TO CHECK HIS APART-
740 DATA MENT? WORK OR APARTMEN
    T?,OOO,SUHONI,WHEN YOU GET
    TO THE,MARKET YOU FIND THAT
     SUHONI
750 DATA HAS GONE TO THE MOSQUE
     TO,PRAY. YOU THINK SHE IS
    PROB-,ABLY HIDING THE DIAMO
    ND,INSIDE THE MOSQUE. THE
760 DATA ONLY WAY TO GET IN THE
    RE IS,TO LIE AND SAY YOU AR
    E,A MOSLEM. YOU COULD JUST,
    WAIT FOR HER. OR YOU COULD
770 DATA SNEAK IN TO THE MOSQUE
    .,WHAT WILL IT BE: MOSQUE..
    .,WAIT... OR SNEAK?,OOO
780 DATA MOSQUE,DENYING YOUR FA
    ITH IS NO,WAY TO OBTAIN A T
    REASURE!,DESPITE YOUR FEELI
    NG OF UN-
790 DATA EASINESS YOU SEARCH TH
    E,MOSQUE. YOUR INVESTIGATIO
    N,OF THE MOSQUE TURNS UP NO
    TH-
800 DATA ING. THIS ADVENTURE IS
     OVER,FOR YOU.,,OOO,XXX
810 DATA WAIT,YOU WAIT AND HOPE
     SHE COMES OUT.,YOUR PATIEN
    CE IS REWARDED.,WHEN YOU LO
    OK UP
820 DATA YOU SEE SUHONI,COMING
    OUT OF THE MOSQUE.,SHE TRIP
    S AND FALLS AND THE
830 DATA DIAMOND FALLS OUT OF H
    ER,ROBE. YOU PICK IT UP AND
     RUN,TO THE SHEIK AND RECEI
    VE,YOUR REWARD!,OOO,XXX
840 DATA SNEAK,AS YOU ARE SNEAK
    ING IN YOU,KNOCK OVER A JAR
    . YOU ARE,DISCOVERED! YOU A
    RE NOT A
850 DATA A MOSLEM AND SHOULDN'T
     HAVE GONE IN ALONE.NO ONE
    WILL,TELL YOU ANYTHING NOW,
    YOU LOSE.,OOO,XXX
860 DATA WORK,YOHASI GETS ANGRY
     WITH YOU,FOR INTERRUPTING
    HIM AT,WORK. HE TELLS YOU T
    O MEET
870 DATA HIM AT THE CAFE AT 6:0
    0. THE,ONLY PROBLEM IS THAT
     NOW,YOU ARE AFRAID OF HIM.
     WHAT
880 DATA ARE YOU GOING TO DO? M
    EET,HIM OR FORGET IT? TYPE
    MEET,OR FORGET.,OOO
890 DATA APARTMENT,IN YOHASI'S
    APARTMENT YOU,FIND A MAP OF
     SHEIK SOHAMI'S,PALACE WITH
     AN X ON THE
900 DATA ROOM CONTAINING SOHAMI
    'S,DIAMONDS. FURTHER SEARCH
     OF,THE APARTMENT TURNS UP
    NOTH-
910 DATA ING. DO YOU WANT TO CA
    LL THE,POLICE AND TURN YOHA
    SI IN,OR WORK OUT A DEAL WI
    TH
920 DATA YOHASI TO SHARE THE WE
    ALTH,FROM THE DIAMOND? TYPE
    ,POLICE OR DEAL,OOO,MEET,YO
    HASI TURNS OUT TO BE A
930 DATA FRIENDLY ENOUGH FELLOW
    . HE,CLAIMS TO KNOW NOTHING
     ABOUT,THE MISSING DIAMOND.
     AFTER
940 DATA YOUR CHAT YOU ARE STOP
    PED BY,A POLICEMAN ON YOUR
    WAY,HOME. THEY FIND A STOLE
    N,RUBY IN YOUR POCKET AND
950 DATA THROW YOU IN JAIL. (YO
    HASI,MUST HAVE PLANTED THAT
     ON,YOU AND TIPPED OFF THE
    PO-,LICE!)
960 DATA BETTER LUCK ON YOUR NE
    XT,ADVENTURE.,OOO,XXX,FORGE
    T,YOHASI IS VERY UPSET ABOU
    T,BEING LEFT AT THE CAFE.
```

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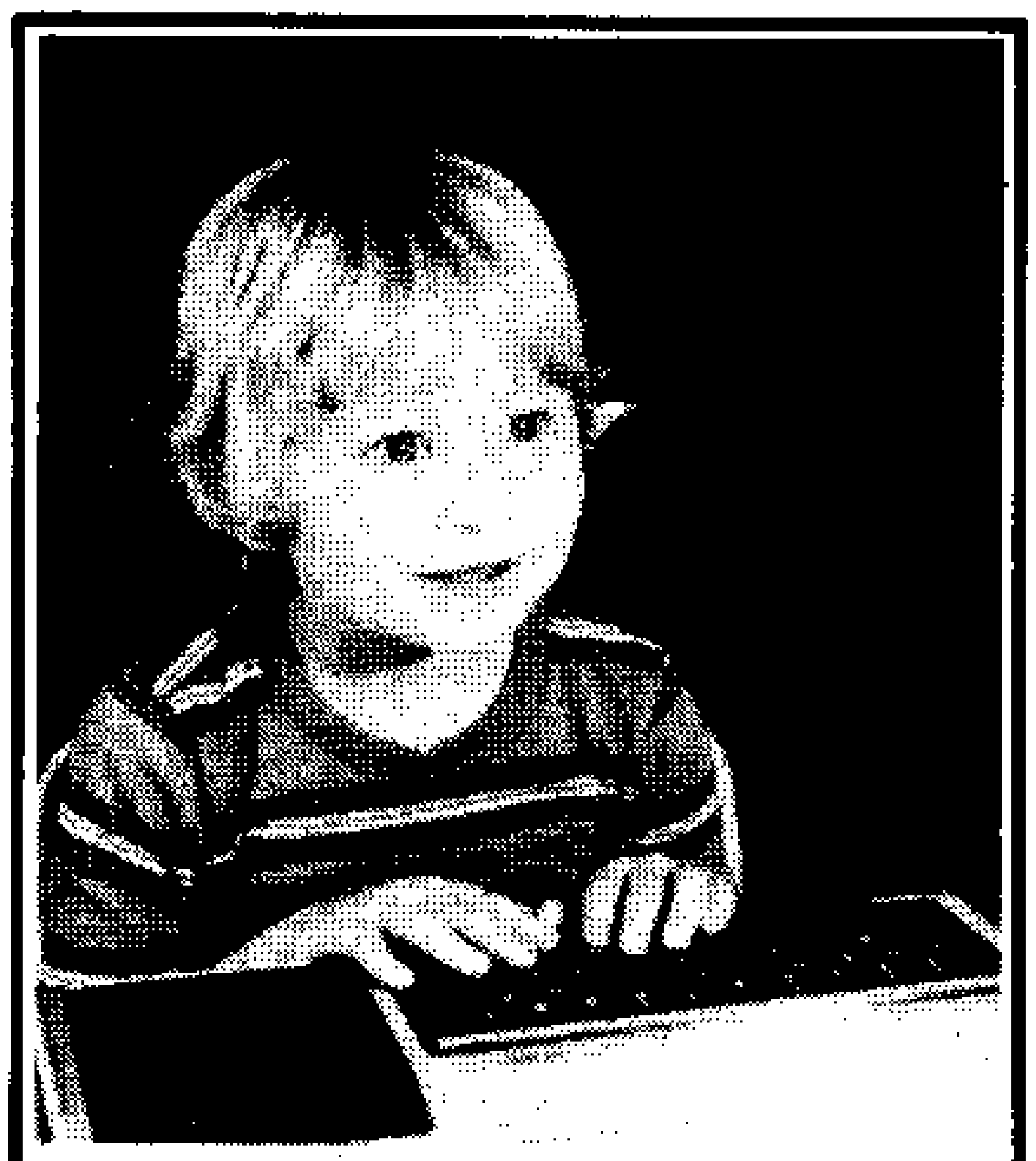
Desert Dilemma

```
970  DATA HE GOES TO HIS BROTHER
     -IN-,LAW THE SHEIK AND TELL
     S HIM,ABOUT YOUR POOR MANNE
     RS.,THE SHEIK CALLS YOU AND
980  DATA TELLS YOU THAT HE WON'
     T GIVE,YOU THE REWARD EVEN
     IF YOU,FIND THE DIAMOND. YO
     U MIGHT AS WELL GIVE UP,OOO
990  DATA XXX,POLICE,THE POLICE
     ARREST YOHASI ON,THE BASIS
     OF YOUR STORY BUT,YOHASI IS
      PROVEN INNOCENT.
1000 DATA YOU ARE SENT TO JAIL F
     OR,FALSELY ACCUSING YOHASI.
     ,OOO,XXX,DEAL,YOU HAVE A LO
     T TO LEARN.
1010 DATA IT HAS BEEN SAID THAT
     THERE,IS NO HONOR AMONG THI
     EVES.,YOHASI PRETENDS TO GO
      ALONG
1020 DATA WITH YOUR DEAL BUT IN,
     REALITY HE MAKES PLANS TO,H
     AVE YOU KILLED. PREPARE TO,
     DIE!,OOO,XXX
1030 DATA OASIS,IN ORDER TO REAC
     H THE OASIS,YOU WILL NEED T
     O HAVE A,MEANS OF TRANSPORT
     ATION. DO
1040 DATA YOU WANT TO USE A CAME
     L OR,DEPEND ON YOUR 1942 JE
     EP?,TYPE CAMEL OR JEEP.,OOO
     ,JEEP,YOU ARE IN LUCK. YOUR
1050 DATA JEEP HAS ENOUGH GAS FO
     R THE,TRIP. YOU SET OUT TOW
     ARD,THE OGAMI OASIS BUT AFT
     ER,THREE HOURS OF DESERT
1060 DATA DRIVING YOUR JEEP QUIT
     S RUN-,NING AND YOU CAN'T G
     ET IT,GOING AGAIN. SINCE YO
     U AREE
1070 DATA ABOUT 180 MILES FROM H
     ELP,AND IT IS 130 DEGREES I
     N,THE SHADE YOU HAD BETTER,
     GIVE UP NOW.,OOO,XXX
1080 DATA MARKET,THAT WAS A WISE
      CHOICE.,BOTH MERCHANTS WEN
     T DIRECT-,LY FROM THE WELL
     TO THE
1090 DATA MARKET. YOUR DISCUSSIO
     N WITH,THEM IS NOT MUCH HEL
     P HOW-,EVER. THE DATE MERCH
     ANT
1100 DATA TELLS YOU THAT EATING
     DATES,WILL GIVE YOU WISDOM.
      THE,OIL MERCHANT SAYS YOU,
     SHOULD HAVE A NAP AND
1110 DATA DECIDE LATER. WHAT DO
     YOU,WANT TO DO? EAT OR SLEE
     P?,OOO,EAT,THE MERCHANT CON
     S YOU OUT
1120 DATA OF YOUR LIFE'S SAVINGS
      FOR,A POUND OF DATES. AFTE
     R,EATING THEM YOU DON'T FEE
     L,ANY WISER. IN FACT YOUR
1130 DATA STOMACH FEELS A BIT QU
     EASY.,SINCE YOU ARE NOW BRO
     KE AND,ILL YOU HAVE TO GIVE
      UP,YOUR QUEST. SORRY!,OOO
1140 DATA XXX,SLEEP,A NAP SOUNDS
      LIKE A,GREAT IDEA. THE ONL
     Y PROBLEM,IS THAT THE MOMEN
     T YOU ARE
1150 DATA ASLEEP THE OIL MERCHAN
     T,STEALS ALL YOUR MONEY AND
     ,SUPPLIES LEAVING YOU,WITHO
     UT RESOURCES TO GO ON
1160 DATA WITH YOUR ASSIGNMENT S
     ORRY!,OOO,XXX,CAMEL,SINCE Y
     OU DON'T OWN A CAMEL
1170 DATA YOU'LL HAVE TO BUY ONE
     . UN-,FORTUNATLY YOU HAVE N
     O MON-,EY. YOU SUCCEED IN G
     ETTING A
1180 DATA CAMEL BY TRADING YOUR
     JEEP.,AFTER TRAVELING INTO
     THE,DESERT FOR ONE FULL DAY
      YOU
1190 DATA ARRIVE AT THE OGAMI OA
     SIS.,THE MERCHANTS ARE NOT
     THERE.,HOWEVER YOU MEET TWO
      HORSE
1200 DATA BREEDERS AND DISCUSS T
     HE,SITUATION WITH THEM. OB,
     OHAMI THE OLDER OF THE TWO
1210 DATA FEELS THAT YOU SHOULD
     INVES-,TIGATE AFSHIN RAH-TH
     E AWFUL-,WHO HAS BEEN KNOWN
      TO,STEAL JEWELS.ALI
1220 DATA HUBIMI A NERVOUS-LOOKI
     NG MAN,SAYS YOU SHOULD FORG
     ET THE,WHOLE THING AND BECO
     ME A
1230 DATA HORSE RACER. WHOM DO Y
     OU,BELIEVE? OB OR ALI?,OOO,
     OB,AFSHIN IS A VERY DANGERO
     US
1240 DATA AND POWERFUL MAN. IF H
     E,FINDS OUT YOU ARE SPYING
     ON HIM,HE WILL HAVE YOU KIL
     LED.ONE OF
1250 DATA RAH'S MEN IS HERE AT T
     HE,OASIS. HE LOOKS AT YOU S
     US-,PICIOUSLY WHEN YOU ASK
     HIM
1260 DATA ABOUT THE DIAMOND. LAT
     ER YOU,SEE HIM SHARPENING H
     IS SCIM-,ITAR. IT MAY BE TO
     O LATE TO
1270 DATA SAVE YOUR LIFE.YOU SHO
     ULD,HAVE BEEN MORE CAREBUL!
     ,OOO,XXX,ALI,ALI BILKS YOU
     OUT OF ALL OF
1280 DATA YOUR MONEY FOR A HORSE
      WHICH,HE SAYS WILL BE A SU
     RE WIN-,NER. YOU TAKE IT HO
     ME AND
1290 DATA ENTER A RACE. YOU WIN
     !,YOU ENTER AND WIN ANOTHER
     ,AND ANOTHER! THIS COULD BE
1300 DATA THE BIGGEST BREAK OF Y
     OUR,LIFE! YOU CAN HARDLY BE
     LIEVE,THAT YOU WERE WASTING
      YOUR
1310 DATA TIME CHASING THAT SILL
     Y,DIAMOND!,OOO,XXX,ERR
1320 END
```



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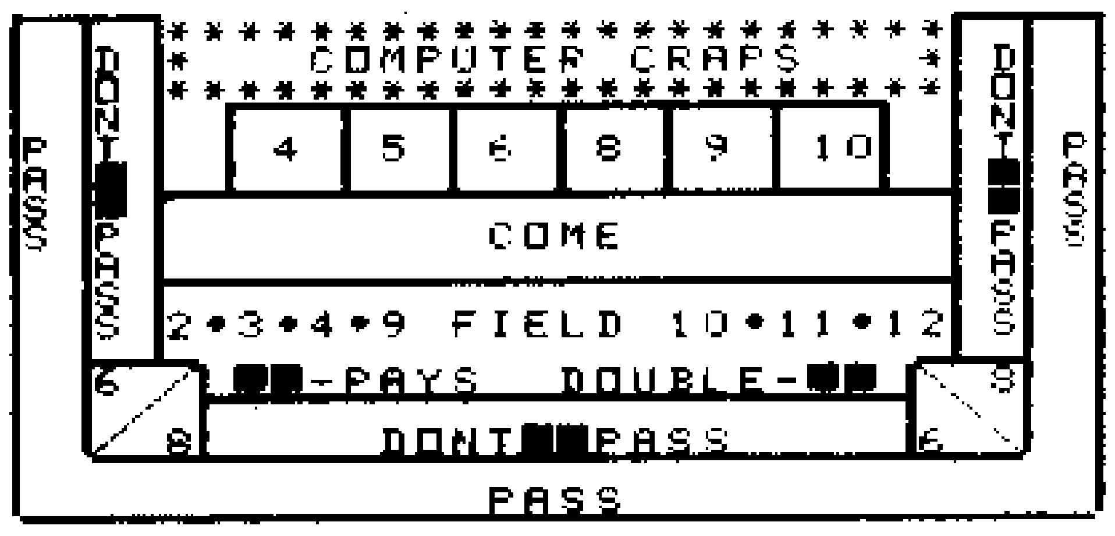

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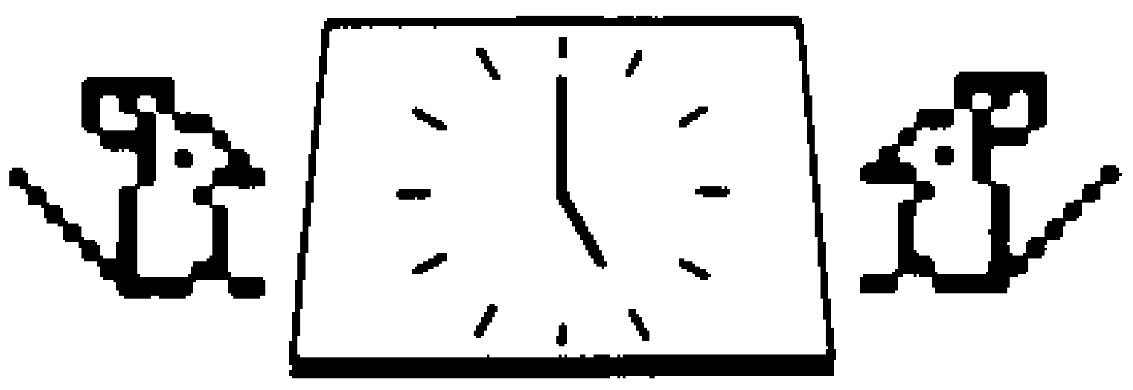

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PicoProcesser . . . from p. 17

Microemulator Explanation of the Program

Line Nos.	
100-150	Program header.
160-540	Set up Picoprocessor front panel graphics.
550-610	Main program loop.
620-690	Read keyboard and branch to appropriate routine.
700-860	Control program flow while Picoprocessor is running; branch to appropriate subroutine.
870-1080	Power switch subroutine.
1090-1160	Initiate pushbutton subroutine.
1170-1260	Run pushbutton subroutine.
1270-1340	Stop pushbutton subroutine.
1350-1540	Load pushbutton subroutine.
1550-1710	Crash subroutine.
1720-2000	Picoprocessor opcode subroutines:
1720-1740	NOP
1750-1780	LDA
1790-1820	ADD
1830-1850	JMP
1860-1890	MOV
1900-1940	HLT
1950-2020	Input from Picoprocessor panel's toggle switches.
2030-2190	Output to Picoprocessor's panel display.
2200-2310	Define graphics characters.
2320-2350	Delay subroutine.
2360-2460	Ask for listing file, set flag and get device parameters.
2470-2500	Check for print/noprint flag; print status or return.
2510-2570	Print Picoprocessor status.
2580-2610	Convert PC to string.
2620-2700	Convert opcode to string.
2710-2740	Convert contents of Reg. A to string.
2750-2760	Convert contents of Reg. B to string.
2770-2900	Convert number to binary string.
2910-2940	Print end-of-run marker.

DELETING PRINTER INSTRUCTIONS

Picoprocessor will be most valuable as a learning tool if it can print the listing showing Program Counter, memory location contents and register contents. This listing will allow you to follow the Picoprocessor's operations step by step. If you don't have a printer, you can still run the Picoprocessor emulator, and watch the changes in Register B as its programs run. In this case, though, you can save yourself some time and typing by entering the program as follows. Type in only **REM** in the following lines: 250, 590, 600, 770, 1240, 1250, 1330, 1490, 1650, 1660, and 1930. **Omit** lines 2360-2940.

Putting REM statements in the early lines allows you to hold your place as you type in your program. Once you've typed it in, however, you can go back and delete these REM statements. You can delete the REM statements in lines 250, 590, 600, 770, 1240, 1250, 1330, 1490, 1650, 1660 and 1930. You **must** change line 750 to read: 750 IF P<16 THEN 780. You can then RESEQUENCE your program.

Listing 1

```
100 REM  ****************
110 REM  * MICROEMULATOR *
120 REM  ****************
130 REM  BY MIKE HILL
140 REM  99'ER VERSION 2.12.1
150 REM
160 DIM R(15)
170 DIM N(3)
180 CALL CLEAR
190 REM  INSTRUCTIONS
200 PRINT TAB(8);"PICOPROCESSOR
    !"::TAB(4);"A 4-BIT MICRO E
    MULATOR"
210 PRINT ::::::"CONSULT DOCUME
    NTATION BEFORE"::"OPERATION
    !"
220 FOR D=1 TO 850
230 NEXT D
240 CALL CLEAR
250 GOSUB 2370
260 PRINT "BUILDING PICOPROCESS
    OR--"::TAB(11);"PLEASE STAN
    D BY..."::::::::::
270 FOR D=1 TO 375
280 NEXT D
290 REM  GRAPHICS
300 CALL CLEAR
310 FOR I=1 TO 22
320 READ E,E$
```

TI-99/4A * SCHEMATICS * HARDWARE

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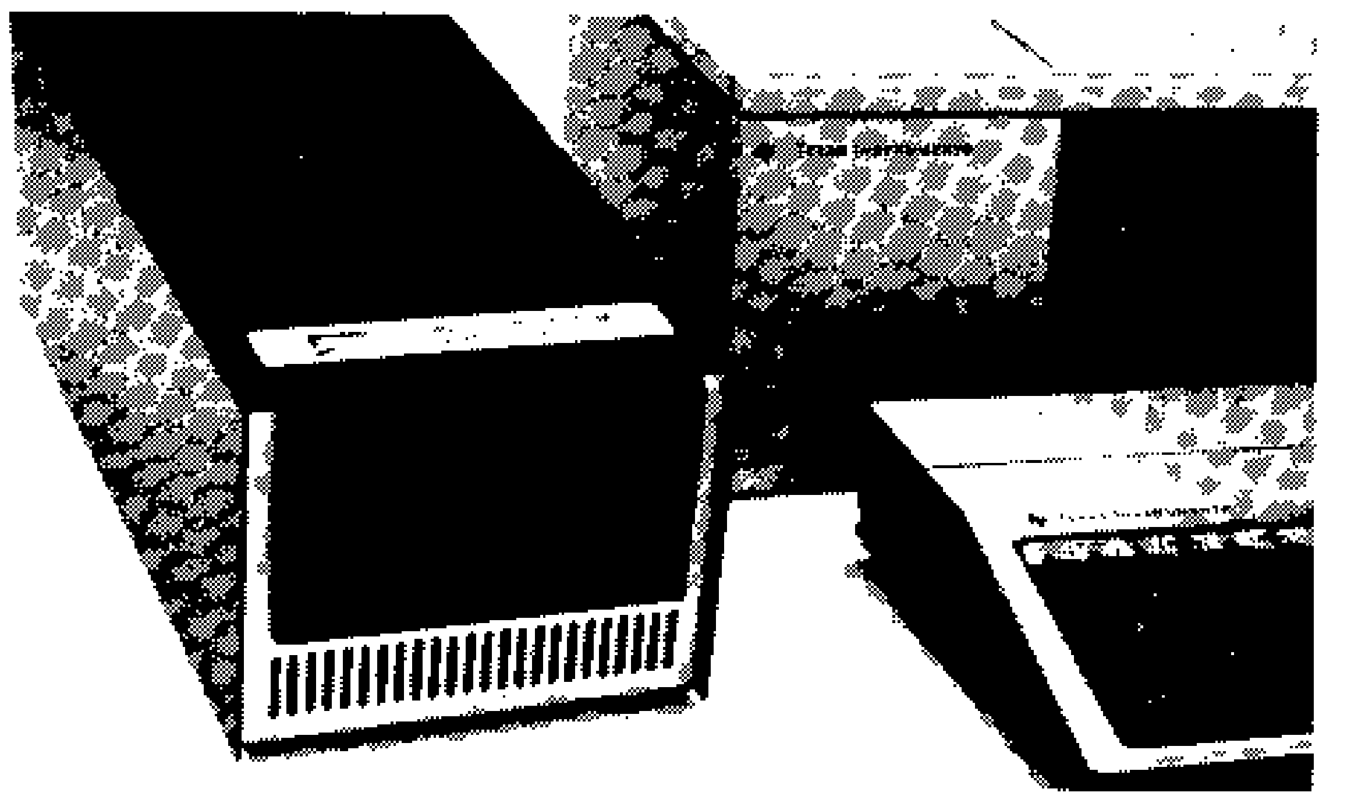

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```
330 CALL CHAR(E,E$)
340 NEXT I
350 CALL SCREEN(2)
360 FOR I=1 TO 14
370 CALL COLOR(I,1,1)
380 NEXT I
390 PRINT ::TAB(9);CHR$(56);"IC
    O";CHR$(56);"ROCESSOR"::TAB
    (26);CHR$(128);"un":::::TAB
    (11);"register B";TAB(25);
400 PRINT CHR$(129);"top":::::T
    AB(5);"busy";TAB(25);CHR$(1
    30);"nit":::TAB(9);"1     1
     1     1"::"   ";CHR$(132);"owe
    r";
410 PRINT "   0    0    0    0    ";
    CHR$(131);"oad"::::
420 FOR I=1 TO 5
430 READ Q,X,Y,Z
440 CALL VCHAR(Q,X,Y,Z)
450 NEXT I
460 FOR I=1 TO 29
470 READ Q,X,Y,Z
480 CALL HCHAR(Q,X,Y,Z)
490 NEXT I
500 FOR I=1 TO 12
510 CALL COLOR(I,2,15)
520 NEXT I
530 CALL COLOR(13,5,15)
540 CALL COLOR(14,10,15)
550 REM  MAIN LOOP
560 CALL KEY(0,C,S)
570 IF C<>69 THEN 620
580 CALL CLEAR
590 IF FLAG=0 THEN 610
600 CLOSE #1
610 STOP
620 IF C<>80 THEN 560
630 GOSUB 880
640 CALL KEY(0,C,S)
650 IF S=0 THEN 640
660 IF POS("PIRSL1234",CHR$(C),
    1)=0 THEN 640
670 ON POS("PIRSL1234",CHR$(C),
    1)GOSUB 880,1100,1180,1280,
    1360,1960,1960,1960,1960
680 IF V-1 THEN 560
690 IF F THEN 710 ELSE 640
700 REM   PROG.RUNNING
710 IF A<16 THEN 730
720 A=A-16
730 IF B<16 THEN 750
740 B=B-16
750 IF P<16 THEN 770
760 P=P-16
770 GOSUB 2480
780 CALL KEY(0,C,S)
790 IF C=83 THEN 670
800 IF C<>80 THEN 830
810 GOSUB 880
820 GOTO 640
830 ON R(P)+1 GOSUB 1560,1760,1
    800,1730,1840,1560,1560,156
    0,1870,1560,1560,1560,1560,
    1560,1560,1910
840 GOSUB 2040
850 IF V-1 THEN 560
860 IF F THEN 710 ELSE 640
870 REM  POWER
880 CALL GCHAR(19,6,M)
890 IF M=92 THEN 950
900 CALL HCHAR(4,6,136)
910 CALL COLOR(2,13,15)
920 CALL HCHAR(19,6,92)
930 V=1
940 GOTO 1080
950 CALL COLOR(2,2,15)
960 CALL HCHAR(19,6,91)
970 CALL HCHAR(4,6,64)
980 CALL HCHAR(14,8,64)
990 B=0
1000 GOSUB 2040
1010 F=0
1020 V=0
1030 FOR I=0 TO 15
1040 R(I)=0
1050 NEXT I
1060 P=0
1070 A=0
1080 RETURN
1090 REM  INITIATE
1100 CALL HCHAR(14,29,94)
1110 P=0
1120 A=0
1130 B=0
1140 GOSUB 2040
1150 CALL HCHAR(14,29,93)
1160 RETURN
1170 REM  RUN
1180 CALL HCHAR(4,29,94)
1190 F=1
1200 L=0
1210 CALL HCHAR(14,8,136)
1220 GOSUB 2330
1230 CALL HCHAR(4,29,93)
1240 IF FLAG=0 THEN 1260
1250 PRINT #1:TAB(10);"********
     * RUNNING"
1260 RETURN
1270 REM  STOP
1280 CALL HCHAR(9,29,94)
1290 F=0
1300 CALL HCHAR(14,8,64)
1310 GOSUB 2330
1320 CALL HCHAR(9,29,93)
1330 GOSUB 2920
1340 RETURN
1350 REM  LOAD
1360 CALL HCHAR(19,29,94)
1370 CALL GCHAR(19,11,N(0))
1380 CALL GCHAR(19,15,N(1))
1390 CALL GCHAR(19,19,N(2))
1400 CALL GCHAR(19,23,N(3))
1410 FOR I=0 TO 3
1420 IF N(I)=92 THEN 1450
1430 N(I)=0
1440 GOTO 1460
1450 N(I)=1
1460 R(P)=(8*N(0))+(4*N(1))+(2*N
     (2))+N(3)
1470 NEXT I
1480 L=1
1490 GOSUB 2480
1500 P=P+1
1510 IF P<16 THEN 1530
1520 P=P-16
1530 CALL HCHAR(19,29,93)
1540 RETURN
1550 REM   CRASH
1560 FOR I=11 TO 23 STEP 4
1570 T=INT(2*RND)
1580 IF T=1 THEN 1610
1590 CALL HCHAR(9,I,40)
1600 GOTO 1620
1610 CALL HCHAR(9,I,136)
1620 CALL KEY(0,C,S)
1630 IF C=80 THEN 1680
1640 NEXT I
1650 IF FLAG=0 THEN 1670
1660 PRINT #1:TAB(10);"@@@@@@@@@
     @"
1670 GOTO 1560
1680 I=23
```

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PicoProcesser

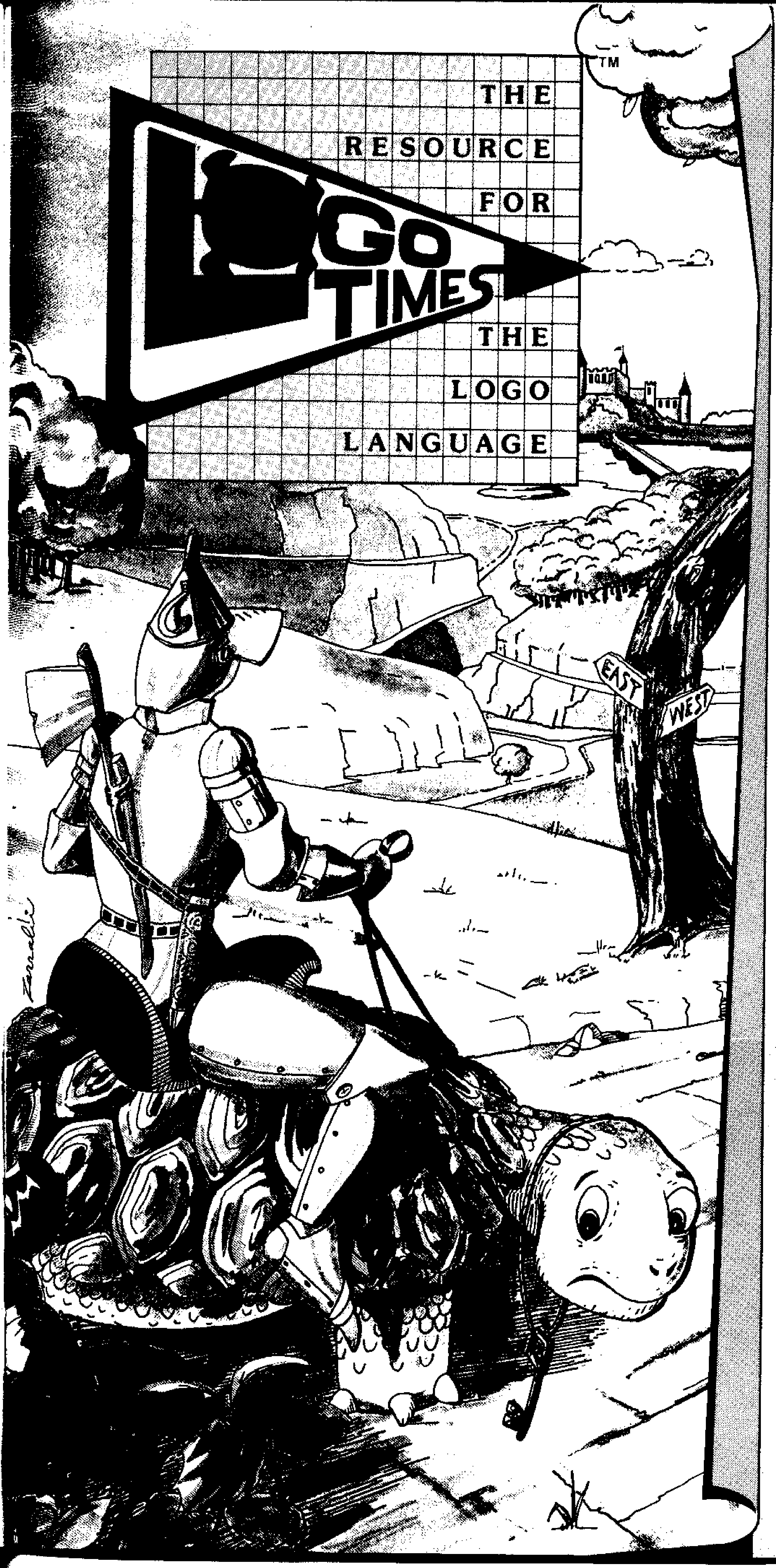
```
1690 F=0
1700 GOSUB 880
1710 RETURN
1720 REM  NOP
1730 P=P+1
1740 RETURN
1750 REM  LDA
1760 A=R(P+1)
1770 P=P+2
1780 RETURN
1790 REM  ADD
1800 A=A+B
1810 P=P+1
1820 RETURN
1830 REM  JMP
1840 P=R(P+1)
1850 RETURN
1860 REM  MOV
1870 B=A
1880 P=P+1
1890 RETURN
1900 REM  HLT
1910 F=0
1920 CALL HCHAR(14,8,64)
1930 GOSUB 2920
1940 RETURN
1950 REM  INPUT
1960 C=C-48
1970 CALL GCHAR(19,C*4+7,M)
1980 IF M=91 THEN 2010
1990 CALL HCHAR(19,C*4+7,91)
2000 GOTO 2020
2010 CALL HCHAR(19,C*4+7,92)
2020 RETURN
2030 REM  OUTPUT
2040 W=B
2050 U=8
2060 FOR I=0 TO 3
2070 N(I)=INT(W/U)
2080 W=W-(N(I)*U)
2090 U=U/2
2100 NEXT I
2110 H=0
2120 FOR I=11 TO 23 STEP 4
2130 IF N(H)=1 THEN 2160
2140 CALL HCHAR(9,I,40)
2150 GOTO 2170
2160 CALL HCHAR(9,I,136)
2170 H=H+1
2180 NEXT I
2190 RETURN
2200 REM  DATA
2210 DATA 50,00FFF,51,0606060
     6060606,52,000000000007070
     6,53,00000000E0E06,54,60E0
     E,55,060707
2220 DATA 56,FC828282FC808080,64
     ,001C3E3E3E1C,40,001C3E3E3E
     1C,91,00000000FE7C7C7C,92,0
     07C7C7CFE
2230 DATA 93,7F7F7F7F7F7F7F,94
     ,003E3E3E3E3E,95,00000000
     00FFFF,96,60606060606066,1
     28,FC828282FC888482
2240 DATA 129,7C82807C0202827C,1
     30,FE10101010101010FE,131,808
     08080808080FE,132,FC828282F
     C80808,136,001C3E3E3E1C
2250 DATA 68,FFFFFFFFFFFFFFF
2260 DATA 2,2,68,22,8,9,51,3,18,
     9,51,3,8,25,96,3,18,25,96,3
2270 DATA 1,1,68,32,24,1,68,32,7
     ,10,95,15,11,10,50,15,17,10
     ,95,15,21,10,50,15
2280 DATA 7,9,52,1,7,25,53,1,11,
     25,54,1,11,9,55,1,17,9,52,1
     ,17,25,53,1,21,25,54,1,21,9
     ,55,1
2290 DATA 4,6,64,1,9,11,40,1,9,1
     5,40,1,9,19,40,1,9,23,40,1,
     14,8,64,1
2300 DATA 19,6,91,1,19,11,91,1,1
     9,15,91,1,19,19,91,1,19,23,
     91,1
2310 DATA 4,29,93,1,9,29,93,1,14
     ,29,93,1,19,29,93,1
2320 REM  DELAY
2330 FOR D=1 TO 100
2340 NEXT D
2350 RETURN
2360 REM  LISTING FILE
2370 INPUT "DO YOU WANT A LISTIN
     G? (Y/N) ":YN$
2380 IF YN$<>"Y" THEN 2440
2390 FLAG=1
2400 INPUT "DEVICE PARAMETERS: "
     :PT$
2410 OPEN #1:PT$
2420 PRINT #1:"  PC","CONTENTS","
     REG A","REG B"
2430 GOTO 2450
2440 FLAG=0
2450 CALL CLEAR
2460 RETURN
2470 REM  PRINT/NOPRINT
2480 IF FLAG=0 THEN 2500
2490 GOSUB 2520
2500 RETURN
2510 REM  PRINT STATUS
2520 GOSUB 2580
2530 GOSUB 2620
2540 GOSUB 2710
2550 GOSUB 2750
2560 PRINT #1:P$,I$,A$,B$
2570 RETURN
2580 TEMP=P
2590 GOSUB 2800
2600 P$=PL$
2610 RETURN
2620 IF L=0 THEN 2640
2630 GOTO 2670
2640 ON R(P)+1 GOTO 2650,2670,26
     70,2670,2670,2650,2650,2650
     ,2670,2650,2650,2650,2650,2
     650,2650,2670
2650 I$="<INVALID>"
2660 GOTO 2700
2670 TEMP=R(P)
2680 GOSUB 2800
2690 I$=PL$
2700 RETURN
2710 TEMP=A
2720 GOSUB 2800
2730 A$=PL$
2740 RETURN
2750 TEMP=B
2760 GOSUB 2800
2770 B$=PL$
2780 RETURN
2790 REM  NUMERIC-BINARY STRING
     CONVERSION
2800 PL$=""
2810 FOR NN=3 TO 0 STEP -1
2820 SQ=2^NN
2830 IF TEMP>=SQ THEN 2860
2840 TEMP$="0"
2850 GOTO 2880
2860 TEMP$="1"
2870 TEMP=TEMP-SQ
2880 PL$=PL$&TEMP$
2890 NEXT NN
2900 RETURN
2910 REM  END-OF-RUN PRINT
2920 IF FLAG=0 THEN 2940
2930 PRINT #1:TAB(10);"#########
     # END"
2940 RETURN
```

Listing 2

```
100 REM  LISTING FILE: DISK TO
    PRINTER
110 INPUT "LISTING FILE NAME: "
    :IN$
120 INPUT "PRINTER PARAMETERS:
    ":OUT$
130 OPEN #1:IN$
140 OPEN #3:OUT$
150 IF EOF(1)THEN 190
160 INPUT #1:A$
170 PRINT #3:A$
180 GOTO 150
190 CLOSE #1
200 CLOSE #3
210 STOP
```

Sample Pico-program Listing

```
 PC     CONTENTS   REG A    REG B
0000      0001      0000     0000
0001      0001      0000     0000
0010      0010      0000     0000
0011      1000      0000     0000
0100      0100      0000     0000
0101      0000      0000     0000
0110      1111      0000     0000
          **********RUNNING
0000      0001      0000     0000
0010      0010      0001     0000
0011      1000      0001     0000
0100      0100      0001     0001
0000      0001      0001     0001
0010      0010      0001     0001
 .         .         .        .
 .         .         .        .
 .         .         .        .
```



Once Upon A Tortoise Shell

by Roger Kirchner

Contributing Editor

I have never played a "real" adventure game, but I am sure that LOGO is the easiest language in which to write one. There is probably no way to prove this point, but I know that I would have not have the patience to write an adventure program in any other language. With LOGO it's fun.

Before beginning my own project, I reviewed an adventure game written in Apple LOGO to find out how adventure programs are played. My program was influenced by that version, but it displays more information at each stage and allows the player to give commands in sentences as well as in one or two words.

The adventure is simple but not trivial. I think it will be an enjoyable game which players can easily modify to add interesting new features. You can do this by changing the data in the INFO procedure. (INFO is described below.)

If you don't have LOGO yet, it is possible (though not easy) to play the game by studying the procedures. Whether you have LOGO or not, you can learn a lot about the list handling capability of LOGO by studying the procedures. Part of the joy of LOGO is implementing and understanding recursive procedures, and many of the procedures here use recursion.

The user should be warned that the procedures just fit in LOGO I's workspace and that they will not run *after* being run, saved, and reloaded. This is because when the program is run, the system creates lists which are saved as part of the workspace. When the workspace is reloaded, these lists are again constructed in memory, and there is then not enough space for the program to re-create them when it is run. Therefore you must type in the program and *immediately save it*. Each time you run the game you need to load this version. You can't, however, run the game, modify it, check your modification and then save it. To modify it, you have to load a version you *haven't* run, modify it and *immediately* save it. This is because of LOGO I's small workspace which can't be managed by erasing values of variables. (LOGO II, on the other hand, has a larger workspace that will permit you to modify, save and rerun this program.)

The Design

In designing any program you have two major tasks: 1) representing the informa-

Introduction

LOGO Times is an information resource for anyone interested in participating in the creation of their own *personal* language—one that will easily allow them to communicate with a computer in a totally new audiovisual realm of applied imagination, exploration, and self-discovery. The articles on these pages concern the use of the new TI LOGO language, but readers do *not* need any additional software or equipment (or even a computer) to understand and learn from the material presented here.

If readers want to actually *experience* a TI LOGO environment, they will need either a TI-99/4 or TI-99/4A computer, the Expansion Memory peripheral, and TI LOGO Command Cartridge. A disk drive, although convenient to have, is *not* required; a user's work may alternately be saved on cassette tape, printed out on the TI Thermal Printer, or hand copied into a notebook (for later re-keyboarding).

In each issue, one or more of the articles may reference or build upon the topics discussed in a previous article. It is therefore recommended that for maximum benefit and understanding, new readers obtain the appropriate back issues of *99'er Home Computer Magazine* containing *LOGO Times* articles.

NOTICE

LOGO Times is actively soliciting articles. Manuscripts should be typed double-spaced, and accompanied by a cassette tape or disk if containing any lengthy procedures or graphics.

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tion to be controlled, and 2) controlling the information. In designing an adventure program, these tasks are especially important. The various places and their relations to other places must be represented, as must be the various objects and the status of each object. Then the program must interpret input from the player and carry out instructions, all the while following the rules of the game.

The LOGO programmer has an enormous advantage over the BASIC programmer. With LOGO one can represent information with lists and manipulate information by recursion. One never has to fuss with array dimensions or subscripts. A Pascal programmer must master record and pointer types to duplicate what is possible in LOGO. Only with LOGO can one instantly try out new ideas.

Our main procedure is ADVENTURE, which has the following simple definition:

```
TO ADVENTURE
INIT
PLAY
END
```

Representing Information

We need to name places, passageways, and objects. Each needs a verbal description. Places might contain objects and have connections to other places. Passageways connect places and may have obstacles. Once we've decided upon relationships, we must work hard to represent them in an ordinary language; with the LOGO language, however, the task is very simple.

The idea is to let a place name such as FOREST be the name of a list whose members consist of three lists, one for each of the required kinds of information. We can define the procedures ITEMS, OPTS, and DESCRIPT, each of which takes a place name for input and returns the corresponding list of information.

The output of ITEMS will be a list of objects in the case of a place and a list of obstacles in the case of a passageway. Initially, for example, ITEMS "FOREST = [AX KNIFE].

The output of OPTS is a list of options corresponding to the possible directions—NORTH, EAST, SOUTH, WEST, UP, DOWN. The option is a place name if there is a place in that direction, a list containing the name of a passageway if there is a passageway in that direction, and the empty list if one can't go in that direction. For example, OPTS "FOREST = [BRIDGE CLEARING CLIFF CLIFF [ ] [ ]]. This indicates that there is a bridge to the north, a clearing to the east, cliffs to the south and west, and that one can't go up or down from the forest.

The output of DESCRIPT is a list describing a place or passageway. For example, DESCRIPT "FOREST = [IN A FOREST].

The procedure INFO is used as a data file to store the names and values for places, passageways and objects. Each line of the procedure contains two kinds of information: the word to be defined and the contents of the list to be assigned to it. The procedure MAKEALL assigns values to the names. This scheme makes it possible to modify the game by just changing INFO. (Using procedures to store data is a very powerful idea. The TEXT command in LOGO II can be used to convert a procedure into a list of lists which can then be manipulated.)

Controlling Information

The PLAY of the game consists of describing the state of affairs to the player, interpreting and carrying out instructions from the player, and stopping play when the adventure is over. The definition for PLAY is:

```
TO PLAY
DESCRIBE
INTERPRET RL
IF DONE? REPORT STOP
PLAY
END
```

DESCRIBE simply describes the player's location and inventory, the objects seen, and possible directions and destinations. The player is advised not to go in some directions or to some destinations.

INTERPRET accepts a list of words for input and attempts to understand it as an instruction. A command will be interpreted as a direction if the direction is the last word of the input. It will be interpreted as an action if the verb is the first word and the object is the last word of the input. If the procedure "can't understand," it waits for the player to enter another instruction.

GODIR moves the player in a given direction if the move is possible. The option is found using the procedure MATCH, which checks the input direction against the list of possible directions and outputs the corresponding item on the option list. If the option is a nonempty list (containing a passageway), the passageway is checked for obstacles. Obstacles must first be removed. For example, if a passageway is locked, it must first be unlocked.

If an action is indicated, a procedure whose name is the given action and whose input is the given object runs. For example, if KNIFE is seen in the forest and TAKE KNIFE is entered, then TAKE "KNIFE will be executed. This will cause KNIFE to be removed from ITEMS "FOREST and added to :INVENTORY.

You can substitute new action procedures in the game. Use the TAKE, DROP, LOCK, and UNLOCK procedures for models, and be sure to add their names to the VERB list in INIT. The adventure can be modified endlessly, your imagination being the only limit. But first, try playing the game as written.

Playing the Game

Begin your adventure by entering ADVENTURE. At any time you can review the possible directions and actions that can be taken by entering HELP. You can make your requests as descriptive as you like, but you must include the name of the direction if you want to go in a given direction, and the name and object of an action in order to carry out an action. Your goal is to bring home a golden chalice. Be careful, and Good Luck!

Continued on p. 71

TURTLE STRUT

SHOWING OFF LOGO

by **Henry Gorman, Jr.**
Contributing Editor

In the age of *Munchman* and *TI Invaders*, people are not impressed by computer demonstrations that simply feature fancy graphics, string manipulations, or music. People expect these as a minimum in any demonstration. TI LOGO shows off its class not because it performs these tricks, but because it allows these effects naturally, in ways conducive to and consonant with logical thought. The best demonstrations of LOGO communicate this and display the equally important LOGO educational philosophy as well. In my experiences learning LOGO and later demonstrating LOGO to young children, teachers and the elderly, I have learned that there are generally more similarities between people than there are differences. I have also found that the differences within homogeneous groups are almost as large as those between dissimilar groups. For these reasons we can discuss LOGO demonstrations effectively without limiting our emphasis to a specific age group.

Teacher as Guide

A teacher introducing LOGO should work with a non-traditional model of the teaching-learning process. Traditionally, people think of teachers as possessing knowledge which they distribute in small doses when the students have demonstrated their readiness. In this model, students who show unusual promise in taking their doses of knowledge are invited further into the sacrosanct ceremonies, and some are eventually ordained into the priesthood of knowledge-dispensers. This model has much to recommend it: It is relatively inexpensive, it is easy to administer, it fits the naive view that learning ability is restricted to a small percentage of the population, and it is flattering to those responsible for education. Unfortunately, this model is terribly wasteful; many students fail to learn, and many more students learn only enough to get by.

LOGO fits a model of learning in which the student and the teacher are learning together; the major distinction between teacher and pupil is that the teacher has been learning longer than the pupil. It is much like a team of explorers which includes many without experience and a guide who has explored many territories. The territory is new for everyone on the team—guide and greenhorns alike. The guide is likely to encounter novel circumstances on the trip as well as many familiar features. When the guide recognizes significant terrain, he points these out to the explorers; a good guide also helps the other explorers learn to "read" the terrain so that they can survive and prosper without his constant supervision. In LOGO the teacher is truly learning along with the students—finding out new things about LOGO and seeing familiar things from different perspectives.

This exploration metaphor is more appropriate than the phrase "learning by discovery" because it avoids excess. I once saw a LOGO demonstration by a teacher who realized that the old hand-out teaching model was inappropriate, but who substituted an even worse guessing-game model in which the students had to discover *everything*. People do not need to learn by discovery that CLEARSCREEN is the command which erases the screen! In my very distant youth, I was told that the proper use of the verbs teach and learn was, "I learn because Mrs. X teaches," and not "Mrs. X learned me." In the exploration model, "Mrs. X learned me" is closer to what happens. This LOGO education philosophy can be employed separately from LOGO the programming language, but the language greatly increases the ease of implementing the philosophy.

Turtle Geometry

There is no obvious essential path of exploration through LOGO Land, but I typically begin teaching LOGO by introducing the turtle and turtle geometry. There are at least two good reasons for starting here. First, it is easy to talk to students about conversing with a turtle and teaching a turtle to do something. Second, although Turtle Geometry is an incredibly rich territory for learning, students tend not to spend much time with the turtle if they begin with the much more exciting sprites.

Seymour Papert, in his numerous memos on LOGO and in *Mindstorms* (Basic Books, 1980), mentions a number of powerful ideas which people can learn from working with LOGO. Many of these are readily accessible in the microenvironment of the turtle. There is a reason why the concept of LOGO *turtle* is so important. Many adults have a fear of touching computers, almost as if an incorrect button-push would short out the U.S. power grid. (Children display this phobia much less often.) When people are introduced to computers by hearing that there is a turtle who can draw things for you, that the turtle is ignorant but willing to learn, and that you give the turtle instructions by typing them in through the keyboard—instructions such as TELL TURTLE or FORWARD 30—then they are not as intimidated. Too often, people have internalized the traditional learning model and assume that the computer is smart and the student is not. The turtle, on the other hand, is NOT smart; the human is smart!

Beyond putting the human in charge of the computer, a first exposure to the turtle can be the vehicle for learning the concept of *state*. The turtle has many different states: its *penstate* (PENUP, PENDOWN, PENREVERSE, PENERASE), its *pencolor* (any 1 of 16 individual colors or any combination of 16 colors), its *location* (as defined either by X and Y coordinates or by distance from a starting point), its *direction* or heading, and its *appearance* (shown or hidden). Each of these states is independent of every other state; adults often confuse heading with position because, I believe, so much of the adult world involves the combination of movement and direction change (e.g., driving). Never-

Continued

VOID **Introductory Offer (see below)
Written by Gregory Kean

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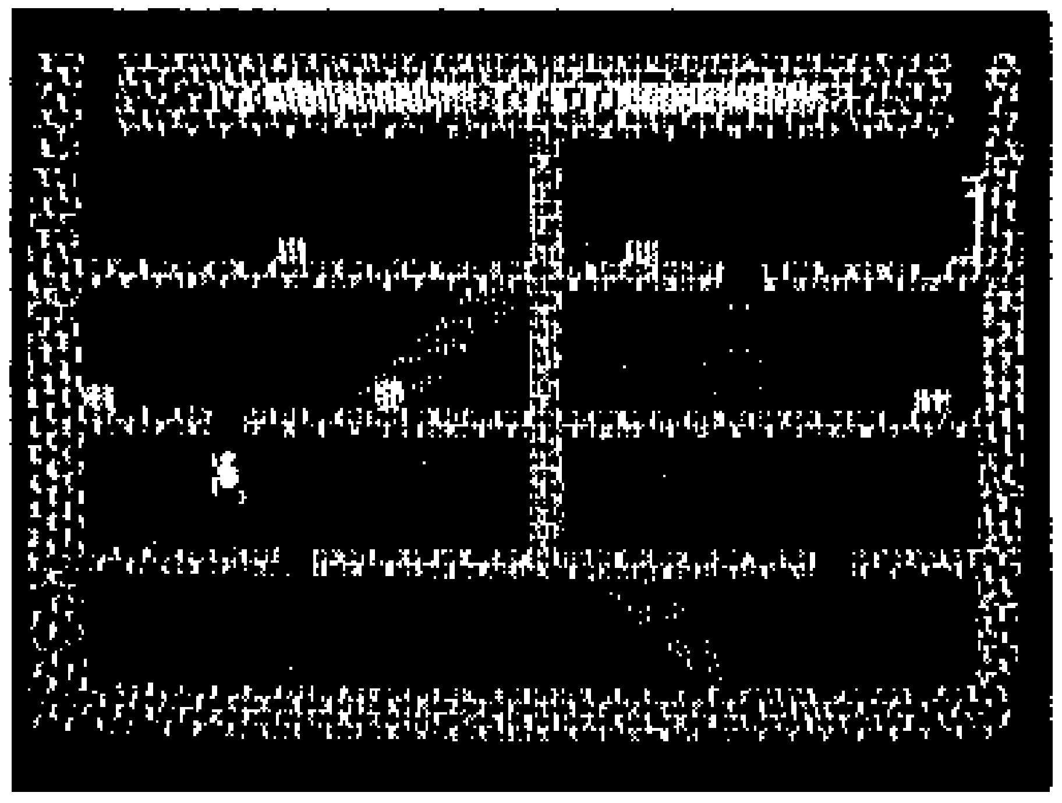
HEIST Written by Gregory Kean



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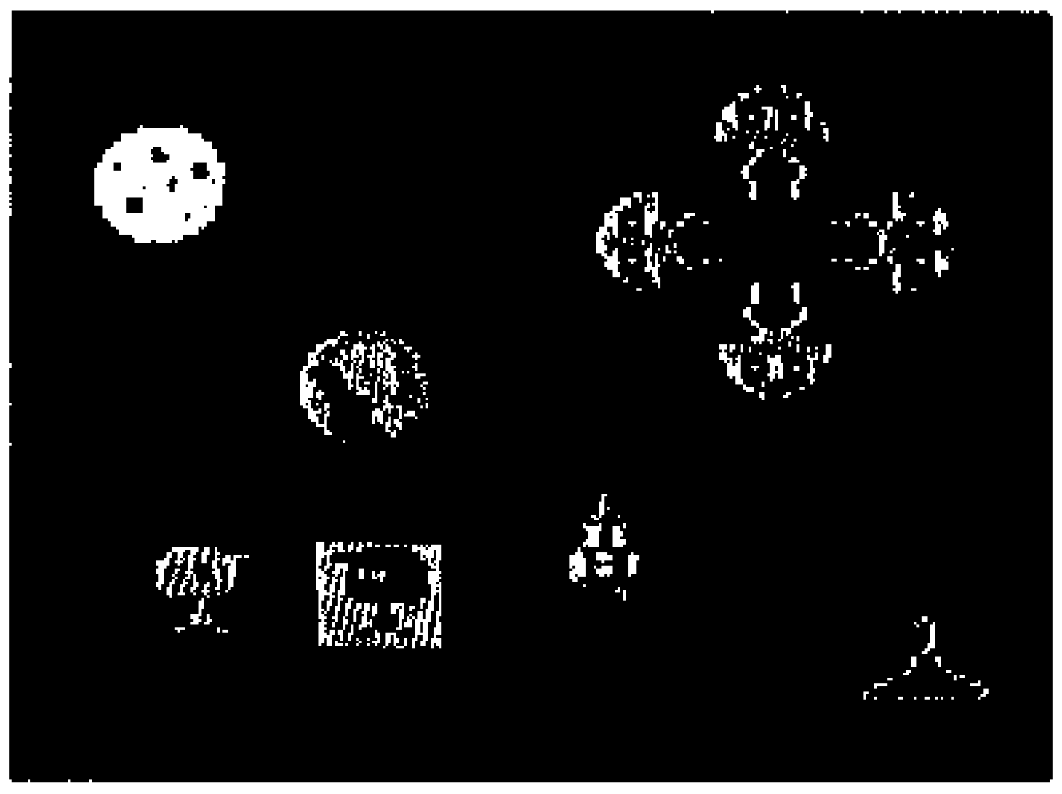
SPRITEMAKER Written by John E. Brown



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theless, the states are independent and separable.

As people tire of the limited number of commands that turtles know and become equally bored with typing, I introduce them to new programming methods. One technique uses a teaching device in which the programmer, as teacher, must tell the turtle how to do a lesson by giving the turtle specific instructions after the programmer has indicated that it should learn the lesson—that is, after catching the turtle's attention by starting off with TO and the lesson name. Sometimes I am asked if the turtle can draw curves or circles. Such questions lead to handy demonstrations of what Papert calls "syntonic learning," or learning which taps into the world knowledge of the learner by having the questioner pretend to be a turtle and talk out loud about what she does as she walks a circle. Then a program can be written to duplicate these actions—forward a little bit, right a little bit, and then redo it all again:

```
TO CIRCLE :SIZE :TURN
FORWARD :SIZE
RIGHT :TURN
CIRCLE :SIZE :TURN
END
```

This program introduces the concept of variable inputs without making a major issue of it. For some, however, it can be too great a step, so I occasionally start off with circle programs with fixed values for SIZE and TURN. Later I complain of the excessive amount of typing needed to change values as a lead into variable inputs. When learners try out the program—using, for example, the procedure CIRCLE 5 5—it makes a circle too big for the screen, and the turtle wraps around the top. Then I ask if it is possible to make a smaller circle with smaller numbers so that the circle would fit on the screen. We try CIRCLE 3 3 but produce a circle of the same size! As people scratch their heads in wonder, I suggest that if we cannot make a smaller circle, why not try to make a giant circle, and I type CIRCLE 90 90. Most people are amazed when this produces a square since they have just seen that this is a circle program. Of course you realize that CIRCLE is just another polygon program since there are no such things as circles, just polygons which approximate them. The surprise caused by a discrepancy between expectation and reality is, in the Piagetian view of learning, a necessary precursor to learning. The turtle is good at demonstrating procedures which are state-transparent (i.e., series of instructions which return the turtle to its initial states). It is then possible to introduce the use of programs as building blocks for larger programs. In this way, structured, procedural thinking flows naturally from the ways the turtle leads people to think of projects (or problems or programming ideas) to the design of computer programs. For example, we can split a turtle program that draws a house into one program which draws a roof and another which makes the body of the house. We might also divide a program to draw a face into building blocks which each draw an eye (used twice), an ear (used twice), a mouth, an outline, and hair.

Sprites and Shapes

Although a person could spend a lifetime exploring turtle geometry, there is much more to LOGO which should be shown in a representative demonstration. Sprites are easily the most visually impressive feature of TI LOGO. I introduce sprites as electronic entities living just below the middle of the monitor which have no shape, no color, and are, in fact, quite invisible. The 32 sprites can be differentiated only by their numbers; each sprite knows what its number is. One talks to sprites much as one talks to the turtle, with a TELL SPRITE 0 or simply a TELL 0. I point out that in order to see a sprite, you have to give him a color (SETCOLOR), then move him into view (HOME or a FORWARD 50), and give him a shape to carry (CARRY :TRUCK). Then I explain that sprites can do everything the turtle can (except those things involving the pen) as well as move with SETSPEED.

If time permits, I demonstrate how to animate with sprites before showing a "burst" program using all sprites. A good quick-and-dirty sprite animation is the bird flapping program from the TI LOGO manual. This, of course, involves a quick discussion of which shapes are built-ins and how to make shapes which are not. Talking to all the sprites with each command can produce pretty results without any programming. For example:

```
TELL :ALL
HOME
SETHEADING :NORTH
CARRY :BALL
EACH [SETHEADING YOURNUMBER
SETCOLOR YOURNUMBER]
```

is a nice demonstration of sprites and of Ohm's law of periodic motion. Even better at demonstrating all sprites in action is

```
TO BURST1
SETUP
CYCLE
END

TO SETUP
TELL :ALL
CARRY :BALL
EACH [SETHEADING YOURNUMBER
SETCOLOR YOURNUMBER]
SETSPEED 0
HOME
END

TO CYCLE
FORWARD 50
WAIT 50
HOME
END
```

which leads to a variation if, in SETUP, the line SETSPEED 40 is added and the FORWARD 50 line in CYCLE is deleted. Then this change invites still another variation on the theme, with replacement of HOME in CYCLE by RIGHT 180. But wait! What happens when you try other angles in CYCLE, such as RIGHT 90 or RIGHT 60?

Words, Tiles and Operations

Much too often people are introduced

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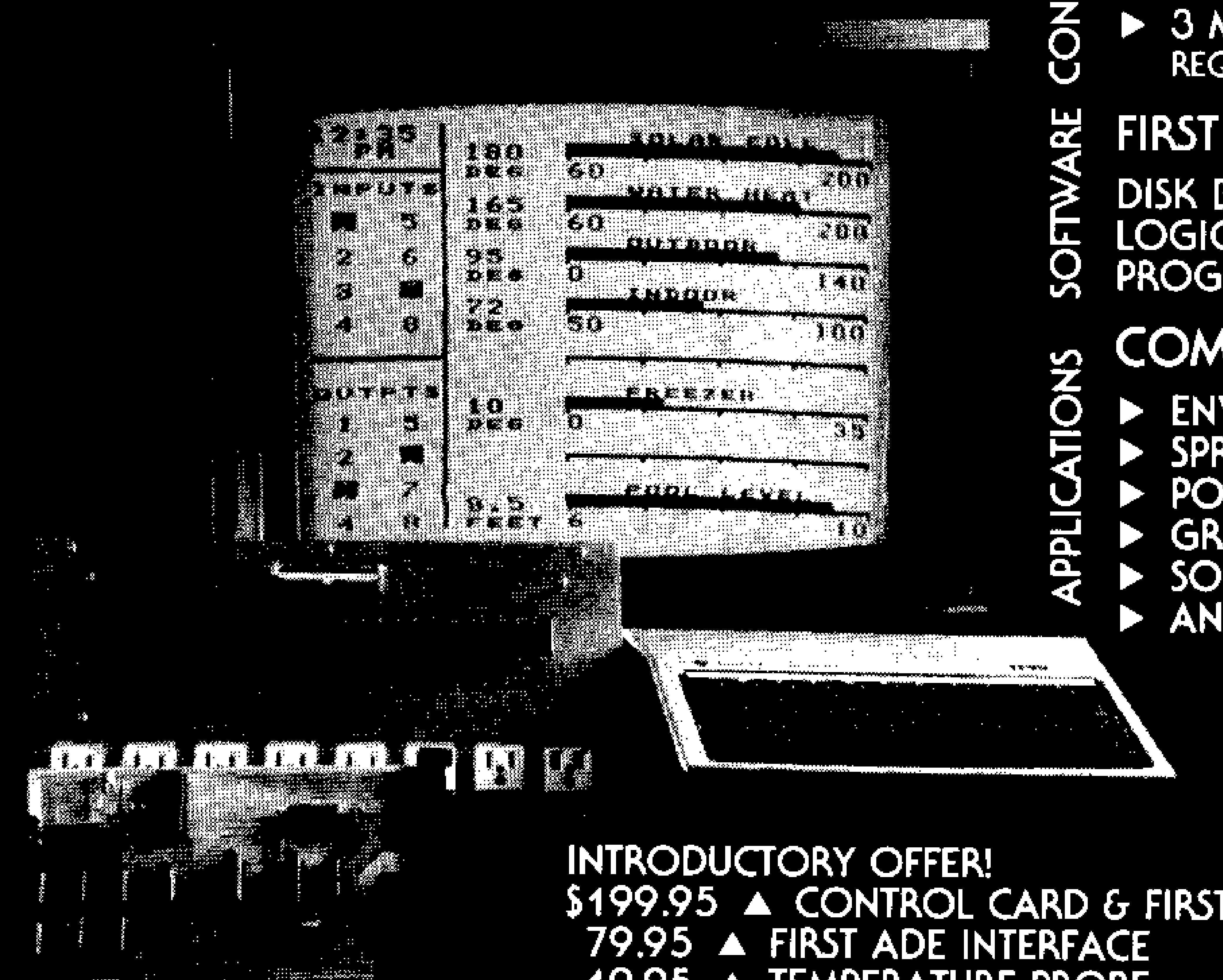

to turtle geometry and sprites and then walk away thinking that LOGO is a keen graphics language but ignoring the power of LOGO as a list-processing language. I was guilty of this serious oversight for several years. Papert makes a useful suggestion about how to introduce a group to lists and their operation: First talk about the game in which one kid says, "Say your name" and the other kid dutifully replies with a hearty "your name." Then compare that way of posing the question with "What are you called?" This, he says, illustrates the same distinction LOGO makes between the name of something—designated with double quotes (")—and the value of something, which is designated with a colon (:). Then he has the group play computer in a MEMBEROF game. Each person in the group pretends to be a part of LOGO and behaves as LOGO does when given a MEMBEROF program. (MEMBEROF outputs "TRUE or "YES if a word is found in a list and "FALSE or "NO if it is not.) Each person must obey the workrules which forbid working past a STOP, END or ANSWER or doing a second program. The game begins with Papert writing out:

```
TO MEMBEROF :WORD :LIST
IF :WORD = FIRST :LIST ANSWER
"TRUE
IF :LIST IS EMPTY ANSWER "FALSE
ANSWER MEMBEROF :WORD BUTFIRST
:LIST END
```

Then he pretends to type into the first member of the group: MEMBEROF "DOG [CAT MOUSE HOUSE COW DOG] and "walks" each of the group through his "job" in doing MEMBEROF.

If there is enough time, then I use an EXPONENT program to show recursion. Almost everyone knows—without doing mental arithmetic—the squares of 1 through 12, and computer buffs know most of the powers of 2. It is a rare person, however, who knows 3 raised to the 4th power. When I pose 3 to the 4th as a problem for my audience and the computer, I point out that the way most people solve the problem is to set it aside and find 3 cubed. If they don't know this, then they temporarily set it aside while they search their memories for 3 squared—then they take that answer, 9, multiply it by 3, and take that answer, 27, and multiply it by 3 and say, "Oh, 3 to the fourth is 81." LOGO does the same with:

```
TO POWER :BASE :EXPONENT
IF :BASE = 0 OUTPUT 0
IF :EXPONENT = 0 OUTPUT 1
OUTPUT :BASE * (POWER :BASE
  :EXPONENT-1 END
```

A nice closing act is to tell people that with LOGO you have complete control over the computer, including being able to change the way all of the symbols (including the blank, screen-forming symbol 32) appear with Make Character (MC).

In a later article I'll talk about demonstrating music and about differences between youngsters and adults in learning LOGO, and follow up with some techniques for "learning" people LOGO. 99'er

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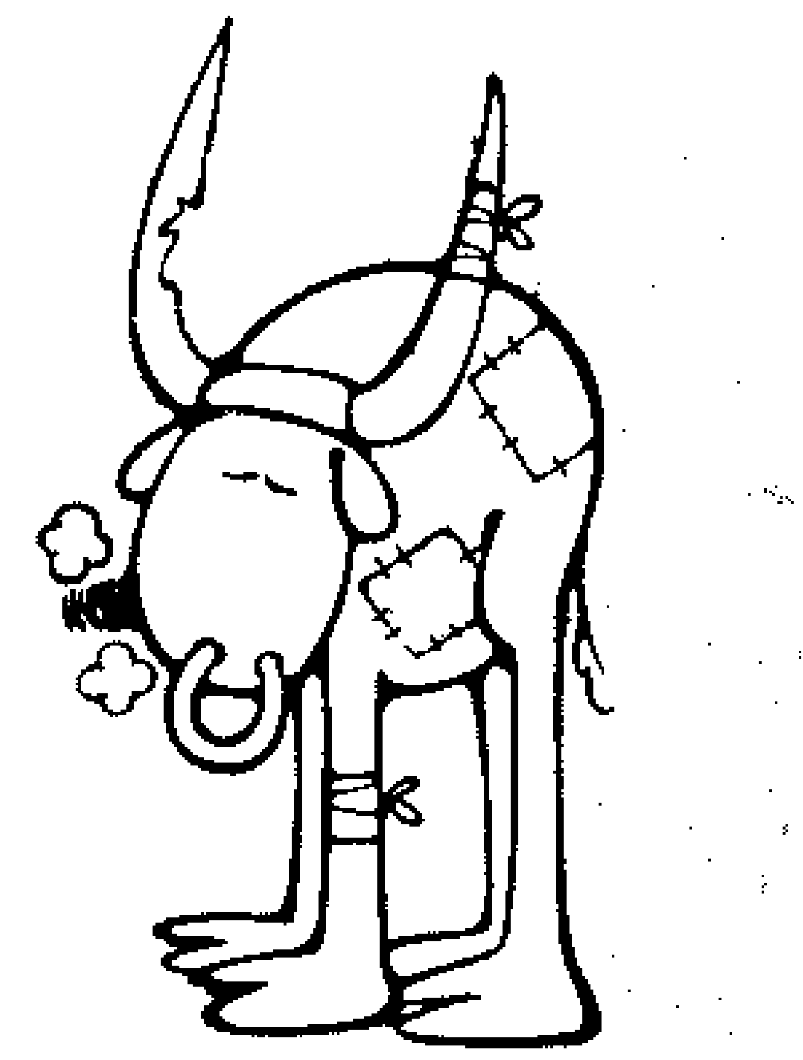

GROUP GRAPEVINE

Group Grapevine: News of TI Users Groups from Around the World.

You've put up notices on bulletin boards, asked your members to spread the word, you've even written to *Group Grapevine*, but your group is still not growing like some of those you read about (see the TI-Gebruikersgroep below). You know there must be all kinds of new TI-owners in town who are dying for some user-friendly assistance. . . and you could use some assistance yourself in putting together the now semi-biannual newsletter.

Well, it might finally be time to start looking for a bigger hall—TI has offered to help. They will pay up to $200 to help you to advertise your group's meeting time and place. How about a big splashy ad for your next *TI-Condor-Ogres* meeting in this Sunday's Ticonderoga Gazette? To take advantage of this once-only offer (which is replacing TI's meeting notice mailout program), write to the **Users Group Coordinator,** P.O. Box 10508 MS 5890, Lubbock, TX 79408.

Word has just blown in from the Windy City that the TI users group there is holding the **Chicago TI Computer Software Fair** on November 12 at the Triton College Center, in the Fireside Lounge. Among the TIPs attending will be *99'er HCM's* own Gary Kaplan who will be speaking on (and demonstrating) some exciting new Home Computer developments. For more information, contact Howard Rosenberg, at 9395 N. Hamlin, Des Plaines, IL 60016.

If Bloomington is anywhere close to Chicago, the members of the **Mid Illinois Computer Resource Organization** (MICRO) might consider car-pooling over to the fair. If you want to help pay gas (or just attend the monthly Bloomington meetings), contact Jerry Walker c/o MICRO, P.O. Box 766, Bloomington, IL 61701.

While we're in the midwest, the president of "South Bend's first TI users group," the **Center Computer Organization,** (P.O. Box 6031, South Bend, Indiana 46660) writes that his group of 11- to 17-year-olds is putting out a call to all TI-oriented teen-agers in the South Bend area. Sorry if you happen to be a South Bender pushing 20. Maybe some spry 22-year-old could start a group for the oldsters.

The TI-users group in Holland will probably not need to take up TI's free advertising offer. The **TI-Gebruikersgroep** writes that their group now numbers 1000 members! (Is it possible that their English interpreter added something in the translation?) These folks are interested in exchanging information/newsletters (their English was actually quite good) with other TI-users. For some international correspondence, write to J.F.v.d. Schaar (Fred, to his friends) at Tulpstraat 11, 1815 XE Alkmaar, The Netherlands. And for international exposure, send your group news and newsletters to the **Users Group Editor, 99'er Home Computer Magazine, 1500 Valley River Drive, Suite 250, Eugene, OR 97401.**

Letters . . . from p. 7

in its definition is caused by the way ASCII enumerates characters.

In line 130 one can replace (M and 12)/4 by INT(M/4), and (M AND 3) by M-4*INT(M/4), but I left them like they are to emphasize that we are operating on pixels.

The program will also accept as input (and will double in size) a character you have redefined or newly defined. In particular you can feed it a part of a just-magnified character. If you store the results and repeat the process, you can magnify your character 4, 16, 32, . . . times, until screen and memory will not hold it.

Michael Jaegermann
College Station, TX

That's a very interesting program, Michael, and no doubt our graphics-oriented readers will find it very useful. With suitable modifications, it could be incorporated as a program segment in a longer program. With other modifications, it could SAVE the characters and their original as well as their magnified definitions—a handy tool for program development.

Hex-Bus Wizardry

Dear Sir,

I was very interested in the article in the March, 1983 magazine which discusses the Hex-bus and the 4/A connection. You had mentioned the fact that the 99/4A will accept the new 99/2 peripherals. As in your February, 1983, article about the Winter Electronics Show, you discussed Hex-bus. I am primarily interested in the ability to use the Wafertape drive.

What excites me about the new Wafertape is that your February, 1983 article indicated it could store up to 48K, access programs by file names and access at faster speeds than cassette. The cost of building a 48K system using the console, expansion box, extended basic module, disk drives and disk controller is prohibitive for many home users.

The Hex-bus and Wafertape make memory expansion and large, rapid storage finally accessible at a competitive price for the home users. I believe this new medium of storage, which could make the 99/4A the most competitive home computer on the market, deserves much more attention in your magazine than has appeared to date.

I am particularly concerned about whether I can use a 32K memory expansion that plugs in the right side port, and plug in the Hex-bus adaptor at the same time. I am also concerned about how the SAVE command works with the wafertape, and whether the Hex-bus adaptor permits chaining non-Hex peripherals such as the RS232 communication box.

Anthony B. Pennington
Springfield, OH

The articles in our Portable Computing *section for August and September contain information on the Hex-bus system and the Wafertape drives. You should find some of the information you're looking for there.*

It is, of course, impossible for us to check out all the possible combinations of devices from all the manufacturers in conjunction with the Hex-bus Interface. We have tried it out with a 32K memory expansion system plugged into the expansion port and the Hex-bus Interface plugged into the memory expansion device. In that configuration, the 99/4A accessed the expansion memory as well as the Wafertape drive. We'll be looking at these peripherals again in the future, and we should be able to give you more information then.

Getting Sprites Right

Dear Sir:

I feel pretty confident using all the commands both TI BASIC and Extended have to offer, but there is one command that is still hard for me to get a hold on. That is CALL SPRITE. When using this with a CALL CHAR statement, I understand that it can define up to four characters per sprite, which would total 64 hexadecimal inputs in the one CHAR statement for that sprite. What I don't understand is how to position those characters within the statement to arrive at a proper looking sprite once the program runs. Normally, with a standard CHAR using four characters in regular BASIC, I could put them in order without difficulty. But when defining a sprite of that size, something happens to my programming. Can you enlighten me on my SPRITEly problem?

James V. Lamb
Monterey Bay, CA

After you define a sprite, you use a character-value in the CALL SPRITE statement. If you use CALL MAGNIFY(3) or CALL MAGNIFY(4) after that, the SPRITE subprogram looks first of all at the character value in the definition for a sprite. If that value is not *evenly divisible by four it uses the* next lower *value evenly divisible by four as the starting point for sprite definition. It then makes the first character the upper left quarter of the sprite, the second character the lower left quarter, the third character the upper right quarter and the fourth character the lower right quarter. For instance, consider the following program segment:*

```
100 CALL CHAR(96,"0")
110 CALL CHAR(97,"FFFFFFFFFFFFFFFF
    FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
    FFFFFFFFFFFFFFFF")
120 FOR I=1 TO 200
130 CALL SPRITE(#2,97,2,88,120)
140 NEXT I
150 FOR I=1 TO 200
160 CALL MAGNIFY(3)
170 NEXT I
```

Line 130 puts a sprite, defined as a solid black rectangle, in the center of the screen. But instead of getting a solid black rectangle in the center of the screen after line 160, you will get a reverse L-shaped figure. The upper left square will be transparent—or the screen color—because the SPRITE won't accept 97 as the beginning character of a magnified sprite definition. Character 96 is the next lower character divisible by four, so it begins there.

Maybe this will help you figure out your sprite and character definition problems, James. The sections in the Extended BASIC manual on the CHARACTER, MAGNIFY and SPRITE subprograms also give the necessary technical information more extensive treatment.

DeBUGS ON DisPLAY

99'er Program Bug

Our **Success Formula** (Sept, 1983 p.48) wasn't quite successful and several sharp-eyed readers noticed that line 2920 should read RESTORE 5830. The problem occurred when the program was resequenced by the computer. **Lost Ruins** enthusiasts, please bear with us and change line 1585 to read IF R1<2 THEN 860 which should "lose" the BAD VALUE message which has been ruining that program for you. There is an addendum to the LOGO **Mosaic Designs** program in the July, 1983 issue (p. 68): Put procedure SCOLOR in as line 1 in DES. Also look for some figures that may help you create your own mosaic tiles in an upcoming Debugs.

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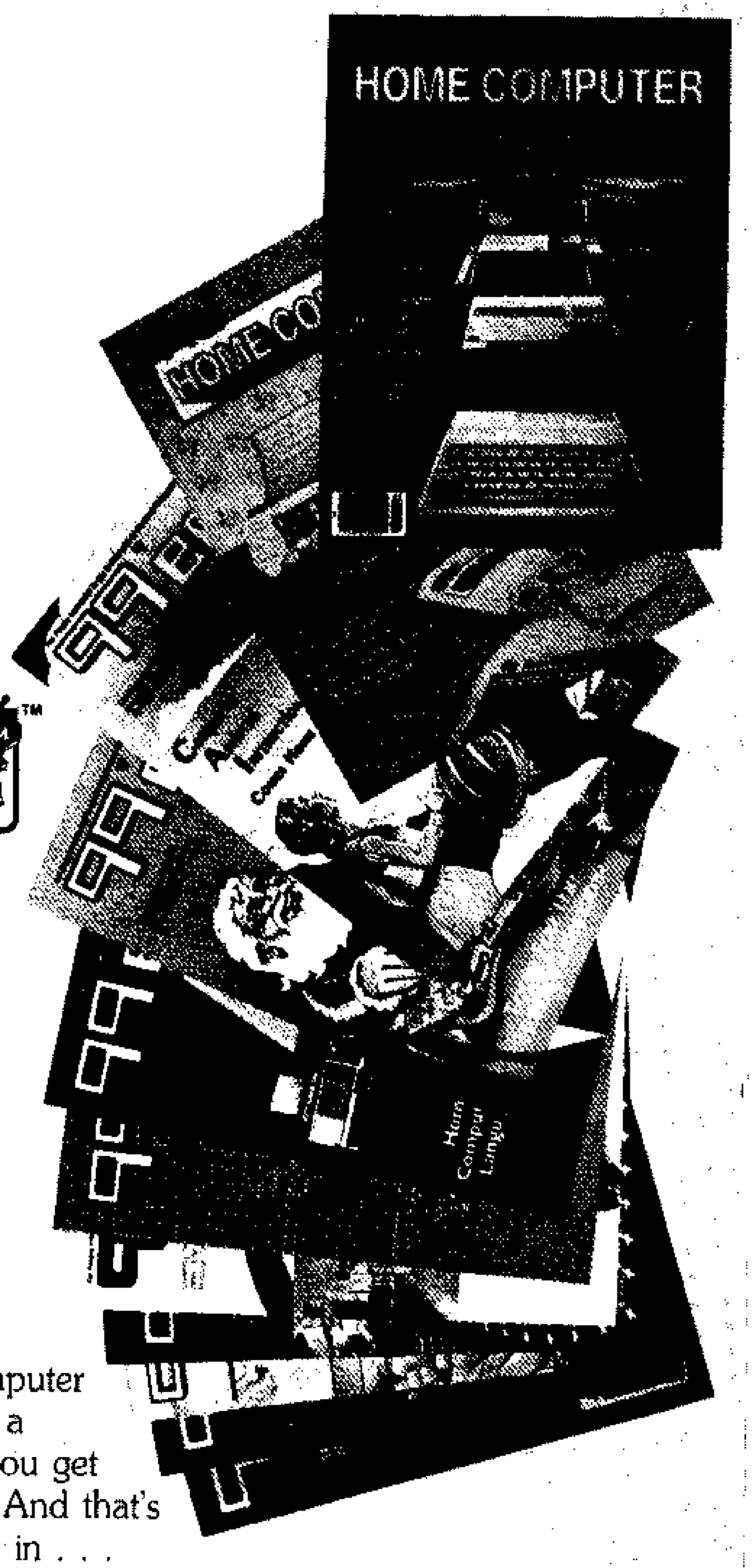

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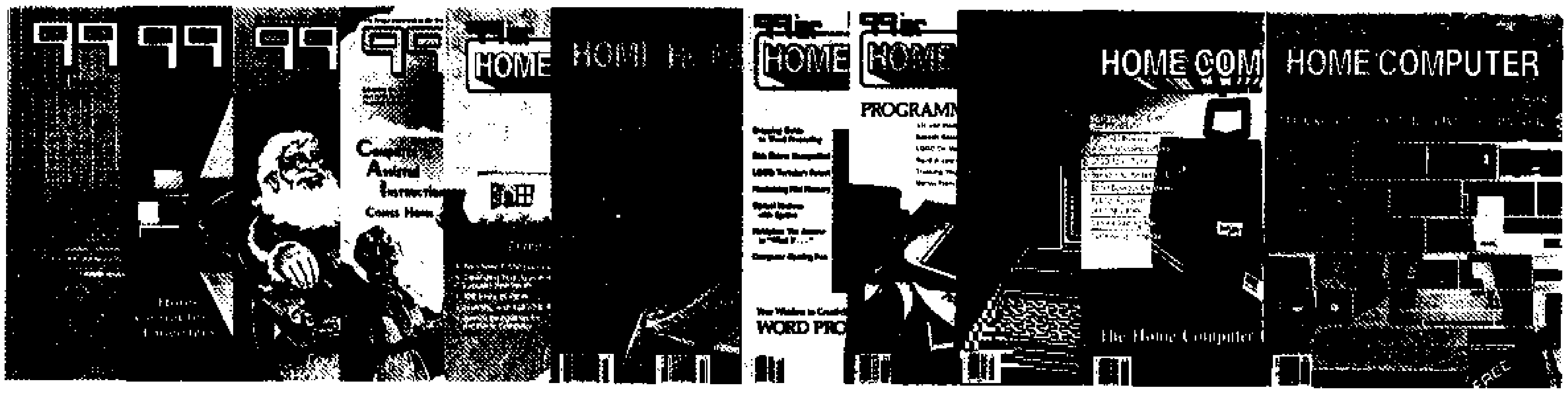

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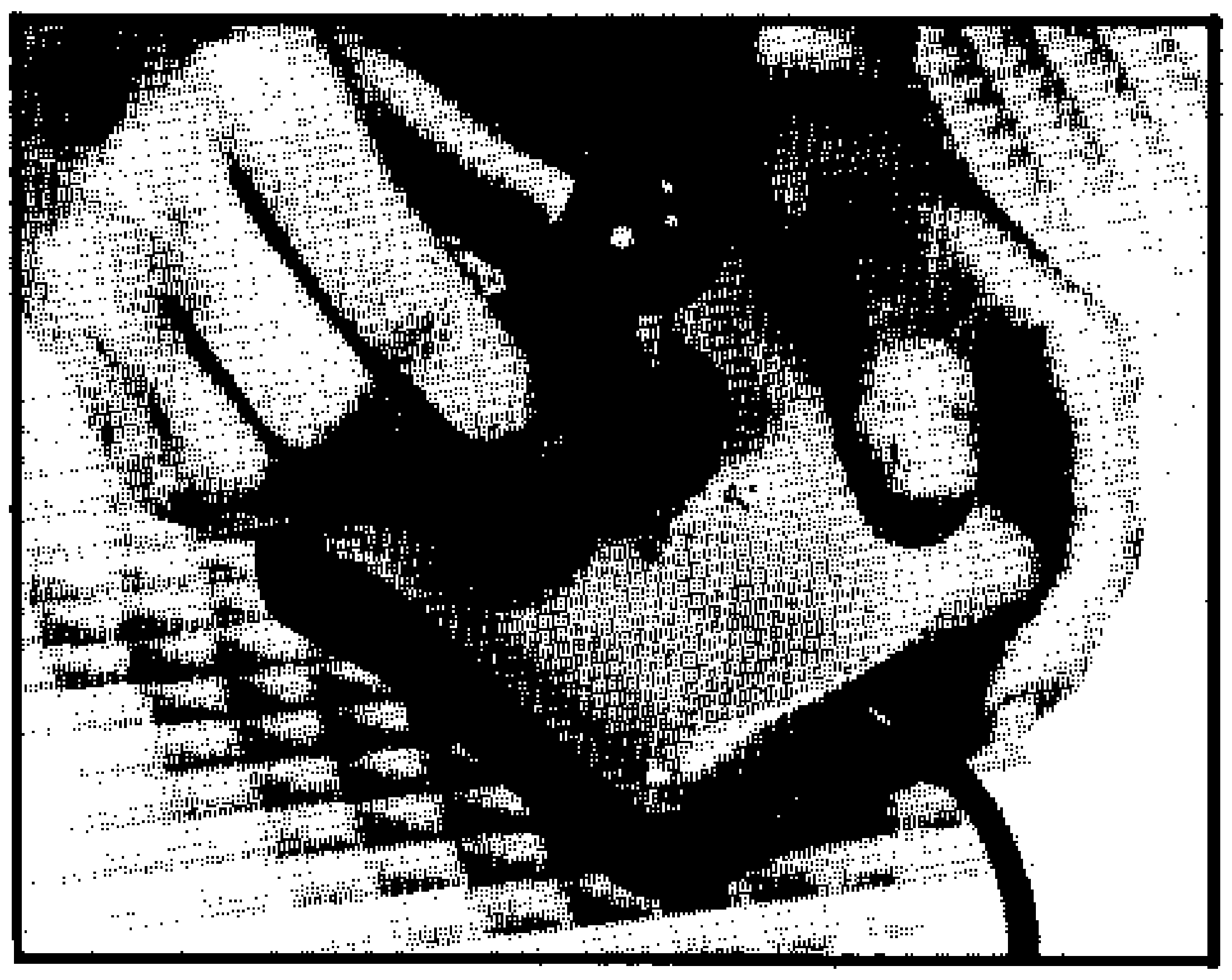
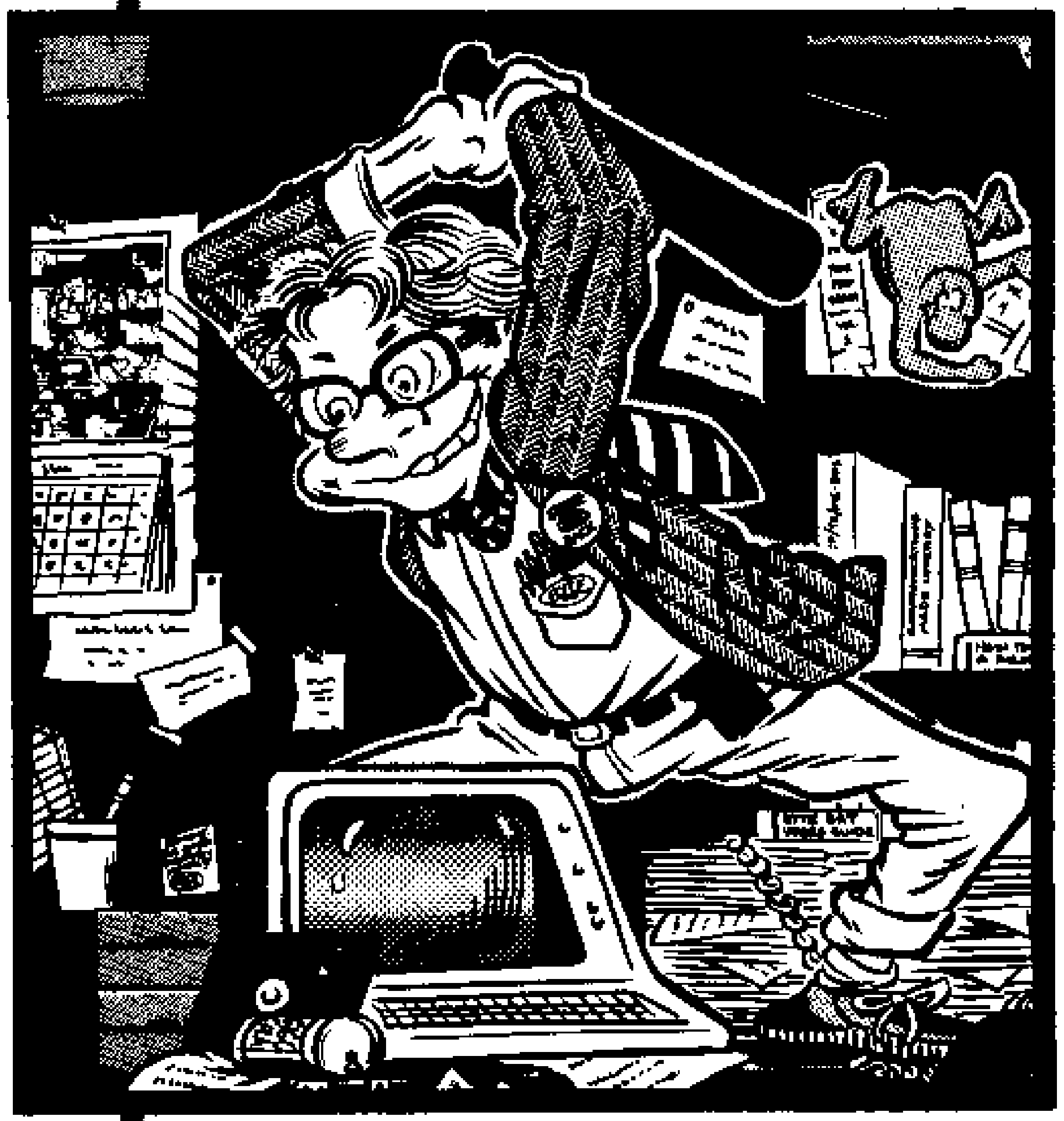


SWITCHABLE JOYSTICK

The Prostick 2002,™ a replacement joystick for the TI-99/4 and 99/4A Home Computers, is now available from Newport Controls. The 4-way/8-way Switchable Gateplate™ will lock-out the diagonal joystick directions for playing arcade games with only vertical and horizontal movement. In addition, the Prostick 2002 comes equipped with two "soft-touch" firing buttons set in the top end of the base to allow either right- or left-handed play. It is backed by a full five-year warranty and has a suggested retail price of $29.95. For more information contact Newport Controls, a Division of Cal-Tron Corporation, 15425 Los Gatos Blvd., Los Gatos, CA 95030.

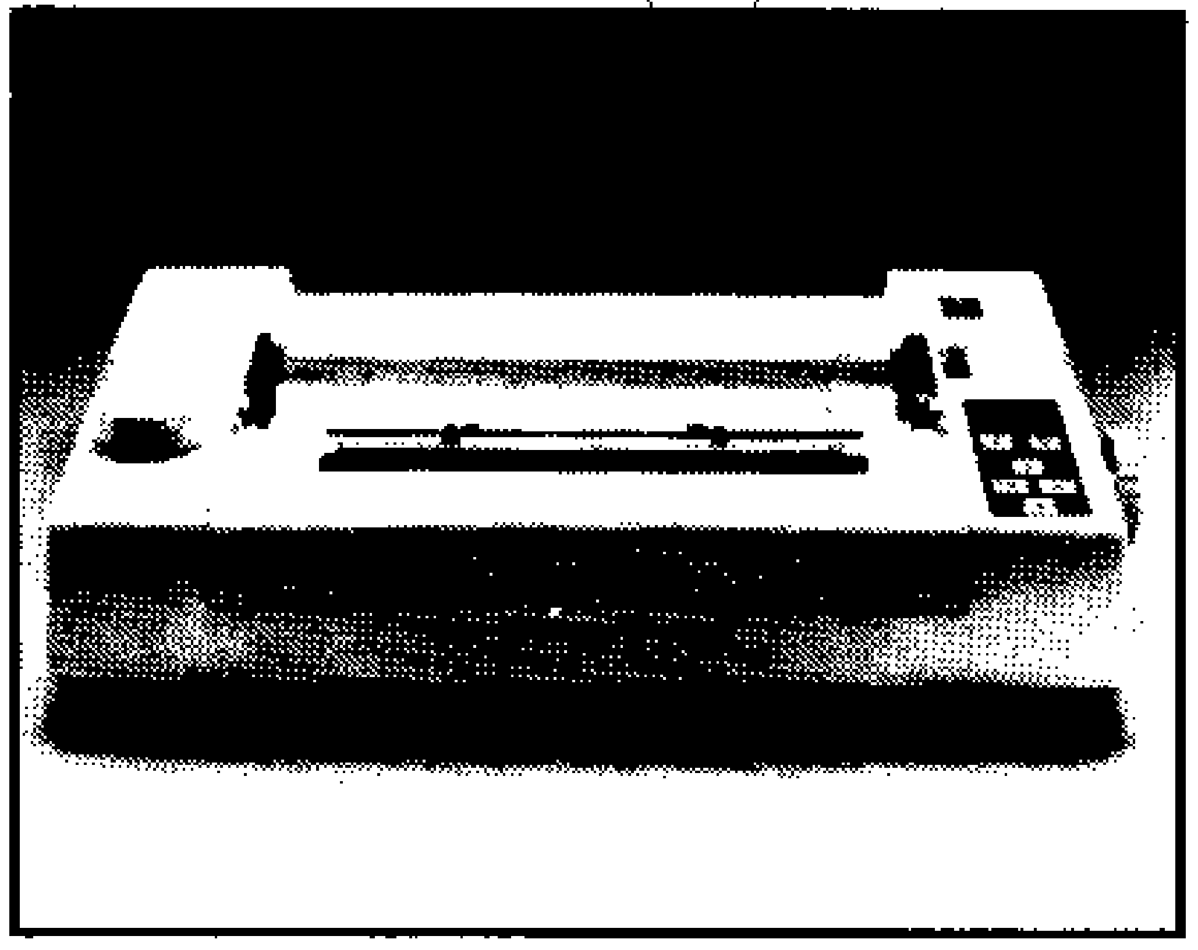


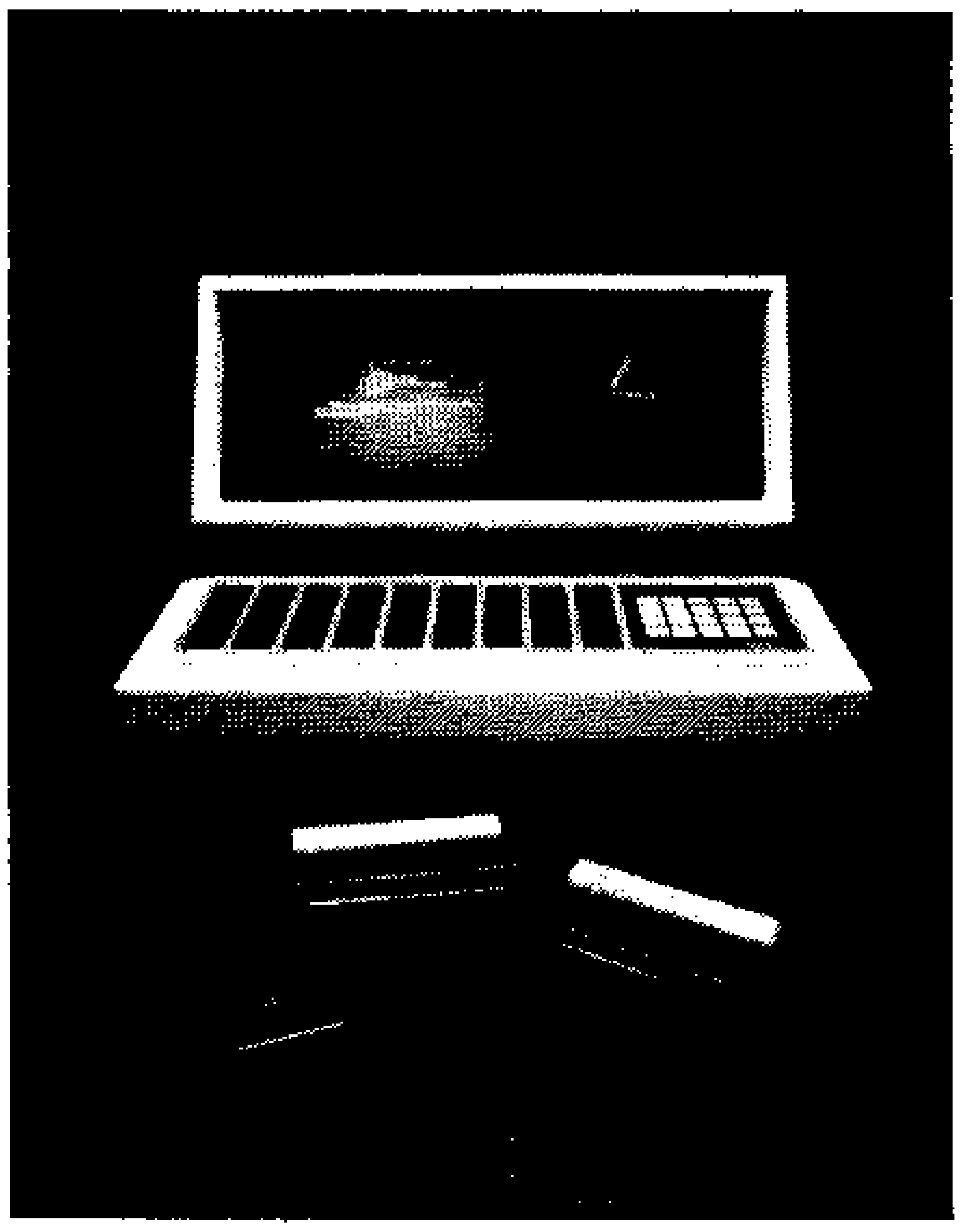
BYTE BAT

MicroTie Corporation has announced the Byte Bat, "the first non-serious computer accessory for the serious computer user." The foam rubber baseball bat, 17" long, will give users a "harmless but satisfying way in which to 'strike back' at computers." The device is compatible with all computers, making it the first universally compatible foamware. Each red, white, and blue Byte Bat box contains a User's Manual, Byte Bat User Button, poster illustrating its use, and a warning decal—"This computer-friendly liveware is protected by Byte Bat." Byte Bats carry a suggested retail price of $9.95 at computer dealers, or can be ordered for $12.50 ppd. by calling (800) 227-3900, in CA (800) 632-2122.

NEW PRODUCTS FROM LEADING EDGE

Leading Edge has introduced "The Trunk," with an alphabetized library index, for storing and carrying floppy disks. Models of the Trunk are offered for 5 1/4"- and 8"-floppy disks, and a cassette-and-game file is offered as well. The Trunk is made of molded plastic with a one-piece hinged lid. Leading Edge has also announced the CX 4800, a four-color printer/plotter that uses four aqueous ball-point pens (black, red, blue, and green), and changes them under command of the user's computer. The plot can cover an effective area of up to 7.6" x 8" at 120mm or 4.8" per second. As a printer the CX 4800 has a speed of 8 cps, with 167 key characters the size of typewriter pica available, including graphic symbols and foreign alphabets. Printing and plotting can be intermixed on the same page, using 9.5" width x U.S. standard 11" or European standard DIN A4 length paper. The printer/plotter has a suggested retail price of $695.00. For more information contact Leading Edge Products, Inc., 225 Turnpike Street, Canton, MA 02021, or call toll-free (800) 343-6833, in MA collect (617) 828-8150.



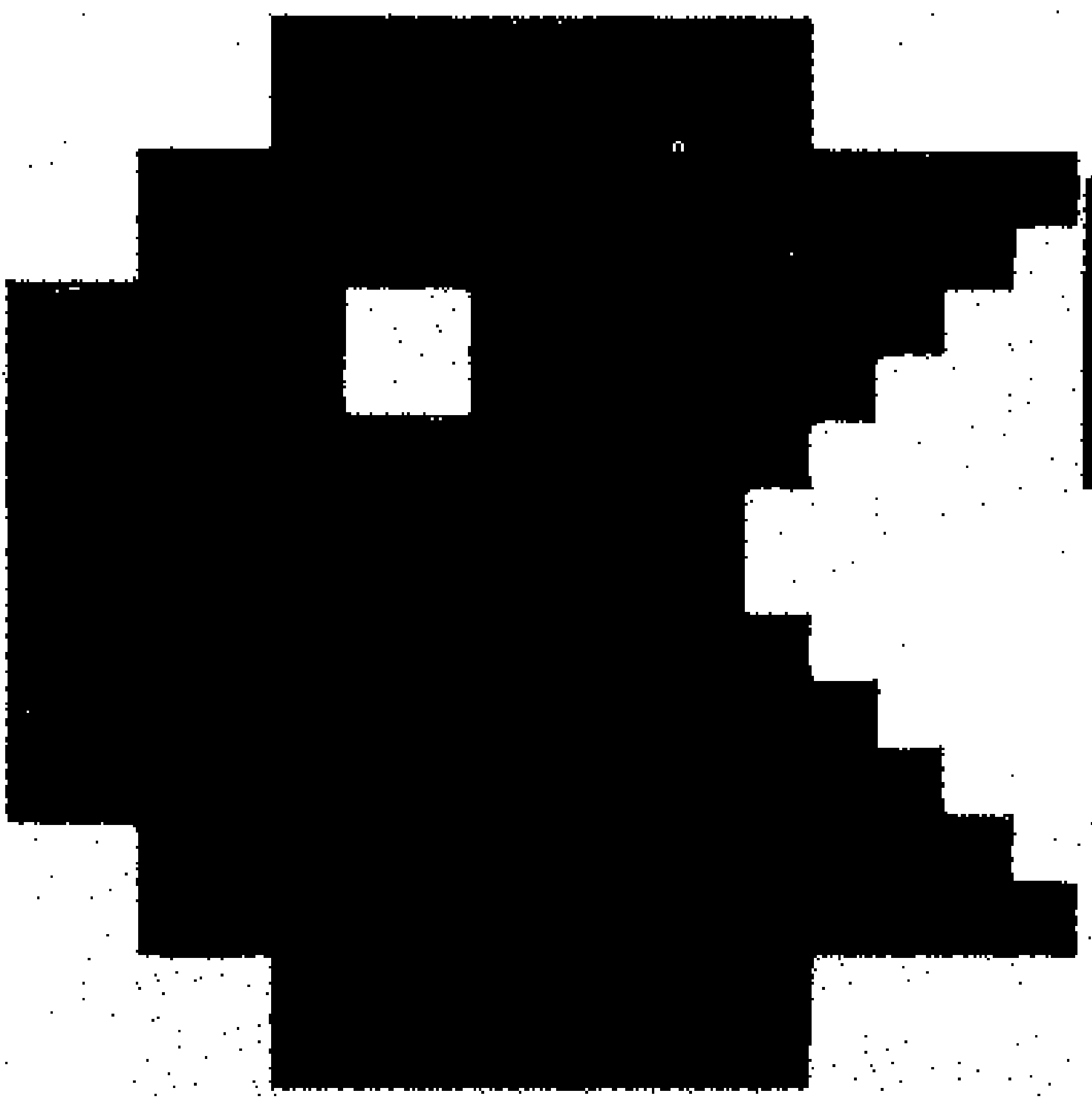


ELECTRONIC DISTRIBUTION AND PROGRAMMABLE CARTRIDGES

Romox,™ Inc. has announced the forthcoming availability of Edge Connector Programmable Cartridges. ECPCs can be erased and reprogrammed, and are compatible with the new in-store Romox Programming Terminals. A "personality module" will be available for TI-99/4A formats. Romox's Programming Terminals will be leased by retailers for their customers' use in selecting and "manufacturing" their own game cartridges or reprogramming their ECPCs. In addition, Romox has converted three of its game cartridges for use on the TI-99/4A computer. *Ant Eater*™ is a two-player game of ant hill survival with increasing levels of difficulty. *Hen-Pecked*™ is another two-player game, with an emphasis on high-resolution graphics. *Princess and Frog*™ is based on the old fairy tale of transformation. All three cartridges are immediately available for the TI-99/4A with a suggested retail price of $39.95 each. Also for the 99/4A Romox offers *TYPO*™ for improving touch typing speed and *Whiz Kid*™, an educational game of words or mathematical equations with an ice-hockey scenario. They each carry a suggested retail price of $39.95. For more information contact Romox, Inc., 501 Vandell Way, Campbell, CA 95008, (408)374-7200.

GENETIC SUPER-COMPUTER GAME

TImagination has announced the release of *PSYBORG*, "the ultimate sci-fi adventure" for the TI-99/4A computer. *PSYBORG* consists of three programs on cassette tape and requires joysticks to run. Animated color graphics and sound effects are featured. PSYBORG is a genetic supercomputer gone out of control. The player must search for and then outwit and disable the computer. *PSYBORG* carries a suggested retail price of $29.95 ppd. from TImagination, Inc., Box 2805, Fairfield, CA 94533.



NUMBER NIBBLER

The Evolution of a Custom-Made Program

by Anthony N. Falco
141 Hudson Street
Northboro, Mass. 01532

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When I became a TI-99/4A owner, my first priority was to get experience and skill as a programmer. I thought a good way to accomplish this would be to write programs in as wide a range of application areas as possible. Since we have a three-year-old son, I gave special attention to computer-assisted instruction for preschool children and set out to write programs to teach the alphabet and numbers. *Number Nibbler* evolved from my work on a "counting program." Its original purpose was to teach the numerals one to nine in association with the counting process.

Homemade Program

I am convinced that children whose parents are able to write educational programs for them have a distinct advantage over those whose parents buy commercially prepared software—even when the home version is not quite as polished as the commercial product! The major advantage is that the home-prepared software can be continually modified, extended, and adapted to meet the rapidly changing needs and interests of the child.

My *Counting Program* underwent many revisions. When my son's interest waned, it was time for a rewrite. Favorite characters evolved from blocks, happy faces, and "Ernie and Bert," to the current variety of nine objects: vans, boats, balloons, houses, boys, cabooses, train engines, ET's, and Munch Man. Favorite songs have changed from "London Bridge" and "Twinkle Twinkle Little Star" to the "Sesame Street Song." When our family got a *Munch Man* Command Cartridge, a major revision took place. Our *Counting Program* became *Number Nibbler*, which would eat and count jelly beans. At this point we were also waiting to receive our free TI Speech Synthesizer, so I incorporated speech into the program. It was a great feeling when *Number Nibbler*, our first program with speech, worked as planned.

The program appeared to be complete. Then it occurred to me, why not design a program for my son to grow into? Addition is an extension of the idea of counting; it is counting two sets rather than one. And if addition, why not subtraction? I now know better than to ever say that the program is complete. But we must stop, at least for the time being, since we are out of memory. And because the program pushes the limits of memory, it was necessary to delete most remarks.

A Learning Experience

I have tried to make the program pedagogically and conceptually sound. It is built around the idea of counting as establishing a one-to-one correspondence between the set of whole numbers and the set of objects counted. I have attempted to incorporate the following educational features:

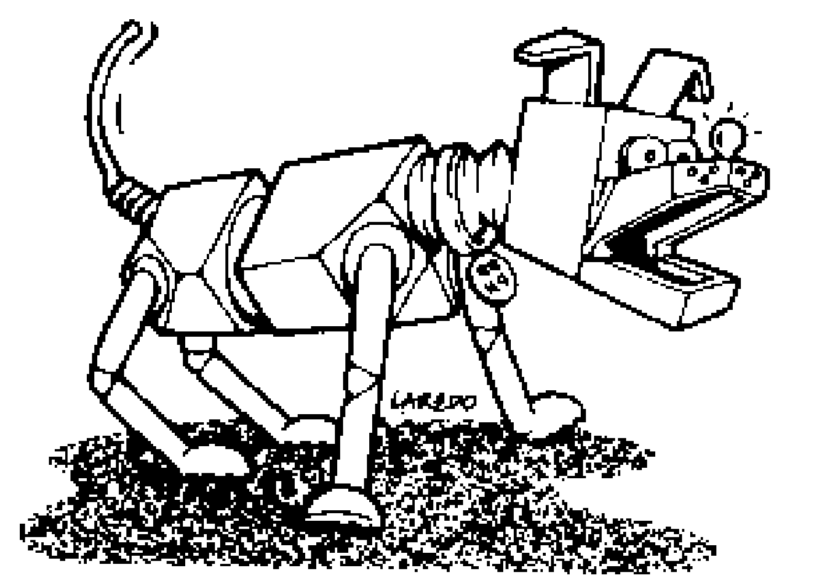
1. Nine different types of figures are used to illustrate that the counting procedure is the same regardless of what is being counted. This also provides variety and color.
2. Four background screens provide a change of scene. In all, 28 color combinations are possible.
3. Responses are reinforced by varied media: speech, music, color, sound effects, and printed words.
4. The user's counting process is reinforced by number nibbling with visual display and spoken words.
5. Addition and subtraction are presented as extensions of the counting process.
6. In addition and subtraction, objects to be counted flash so that the learner always knows what is to be counted.
7. In subtraction, as soon as the user enters the number of objects subtracted, the program literally "takes them away" from the first number and the learner counts the remainder.
8. To reinforce addition, the number nibbler physically merges the two sets of jelly beans, then counts and eats them. Each step is explained with speech.
9. To reinforce subtraction, the subtracted set of jelly beans is superimposed on the first set, then changes colors and disappears, leaving the remainder for the number nibbler. Each step is explained with speech.
10. Verbal encouragement is provided after each correct response.
11. Each number fact is displayed as an equation in large format.
12. Only digits 1 to 9 are used. Zero and place value are saved for a later age.

A common criticism of instructional programs is that they drill but do not teach. I have tried to make this program do both. Readers can "customize" the program for their children by changes in, a) the objects counted in lines 1050 to 1130, b) the shapes that the number nibbler eats in line 310, and c) the song in lines 850 to 880.

Music is surprisingly easy to program. An encyclopedia article on reading music, a trip to the local library for music, an hour or so translating from notes to frequencies, and a song is ready.

Number Nibbler can continue to evolve as both its users and designer master new concepts. For as you will discover in writing educational programs, there are actually two learners involved—the child and the programmer.

August's Choice



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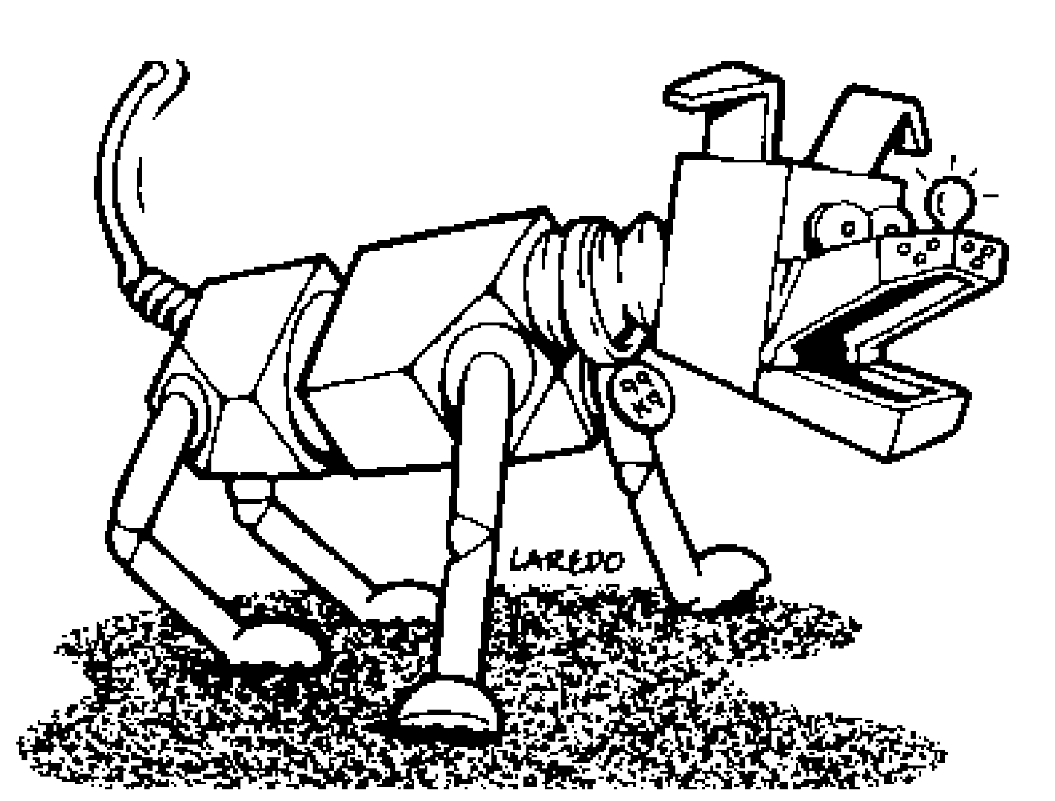
Number Nibbler
Explanation of the Program

Line Nos.	
100-140	Program header.
150-160	Initialize values and characters.
190-210	Title screen and pick options.
220-250	Initialize and select sounds and colors.
260	Initialize and create jelly beans.
270-300	Randomly select problem and establish spacing on the screen.
310-330	Pick colors and figures to display.
340-400	Counting display, response to input, and go to nibble routine.
410	Reset colors and start next sequence.
420	End program
430-450	Establish characters for add and subtract routines.
460-600	Addition and subtraction routines.
610	Say addition fact and play tune.
620-780	Nibbler display for counting routine.
790-840	Display objects for counting.
850-880	Play "Sesame Tune."
890	Display counting.
900	Make box for counting.
910-950	Display equation boxes.
960-1040	Set data pointer for selected figure.
1050-1130	DATA for different shapes.
1140-1230	Objects for counting.
1240-1250	Display appropriate symbol for arithmetic operation.
1260-1580	Nibble demonstration for both addition and subtraction.
1590	Define characters for minus sign.
1600-1620	Blank out subtrahend
1630-1680	Supplement to nibble demonstration on subtraction.
1690	State subtraction fact.
1700	Say answer is good
1710-1720	Flash objects to be counted and accept response.
1730	Establish colors for patterns and background.

```
100 REM ********************
110 REM *   NUMBER NIBBLER  *
120 REM ********************
130 REM BY ANTHONY FALCO
140 REM 99ER VERSION 2.12.1XB
150 V0=0 :: V1=1 :: V2=2
160 CALL MAGNIFY(V2):: CALL CLE
    AR :: RANDOMIZE :: TL=V1 ::
     RW=6 :: CALL CHAR(97,"FFFF
    FFFFFFFFFFFF",134,"F0F0F0F0
    0F0F0F0F")
170 DISPLAY AT(V1,7):"NUMBER NI
    BBLER" :: GOTO 640
180 TL=V0 :: CALL CLEAR :: CALL
     DELSPRITE(#10):: DISPLAY A
    T(3,V1):"PICK ONE:"::"    <1
    > COUNT"::"    <2> ADD"::
190 DISPLAY AT(9,V1):"    <3> SUB
    TRACT"::"YOUR CHOICE?" :
    : ACCEPT AT(12,13)VALIDATE(
    "123")SIZE(1):P$ :: CH=VAL(
    P$)
200 DISPLAY AT(14,V1):"LARGEST
    NUMBER?" :: ACCEPT AT(14,17
    )VALIDATE("23456789")SIZE(V
    1):P$ :: NO=VAL(P$)
210 DISPLAY AT(16,V1):"HOW MANY
     TIMES?" :: ACCEPT AT(16,17
    )VALIDATE(DIGIT):M
220 H=V0 :: RESTORE 230 :: FOR
    A=V1 TO 9 :: READ T(A):: NE
    XT A
230 DATA 523,587,659,698,784,88
    0,988,1047,1175
240 FOR W=V1 TO M :: QQ=INT(V2*
    RND)+V1 :: B=V2*(INT(4*RND)
    +V2):: IF B=6 THEN B=11
250 CALL COLOR(V1,B,B):: CALL S
    CREEN(B):: CALL COLOR(V2,14
    ,B):: CALL COLOR(12,15,B)::
     CALL COLOR(13,B,16)
260 CALL CLEAR :: CALL COLOR(14
    ,14,B):: CALL CHAR(42,"001E
    7E7E7E7C78")
270 IF CH=V1 THEN J=INT(NO*RND)
    +V1 ELSE J=INT((NO-V1)*RND)
    +V2 :: CALL DELSPRITE(#V1)
280 IF CH=V1 THEN IF J/V2=INT(J
    /V2)THEN S=(36-3*J)/V2 ELSE
     S=(35-3*J)/V2+V1 :: GOTO 3
    10
290 IF (J+V1)/V2=INT((J+V1)/V2)
    THEN S=(34-3*(J+V1))/V2 ELS
    E S=(33-3*(J+V1))/V2
300 IF CH=3 THEN S=S+V1
310 ST=S :: ON INT(RND*9)+V1 GO
    SUB 960,970,980,990,1000,10
    10,1020,1030,1040
320 READ CL,CP :: CALL COLOR(10
    ,CL,B):: FOR X=104 TO 107 :
    : READ P$ :: CALL CHAR(X,P$
    ):: CALL CHAR(X+12,P$):: NE
    XT X
330 CALL COLOR(11,CL,B):: IF CH
    >V1 THEN 430
340 H=V0 :: I=V0 :: V=J :: GOSU
    B 790 :: GOSUB 900
350 CALL KEY(V0,X,Y):: IF Y=V0
    THEN 350 :: IF X<>J+48 THEN
     CALL SOUND(1000,131,V2)::
    GOTO 350
360 N$=STR$(J):: CALL SAY(N$)::
     D=ASC(N$):: GOSUB 890
370 GOSUB 850 :: CALL CLEAR ::
    CALL DELSPRITE(ALL):: GOSUB
     1700
```

Continued on p. 65



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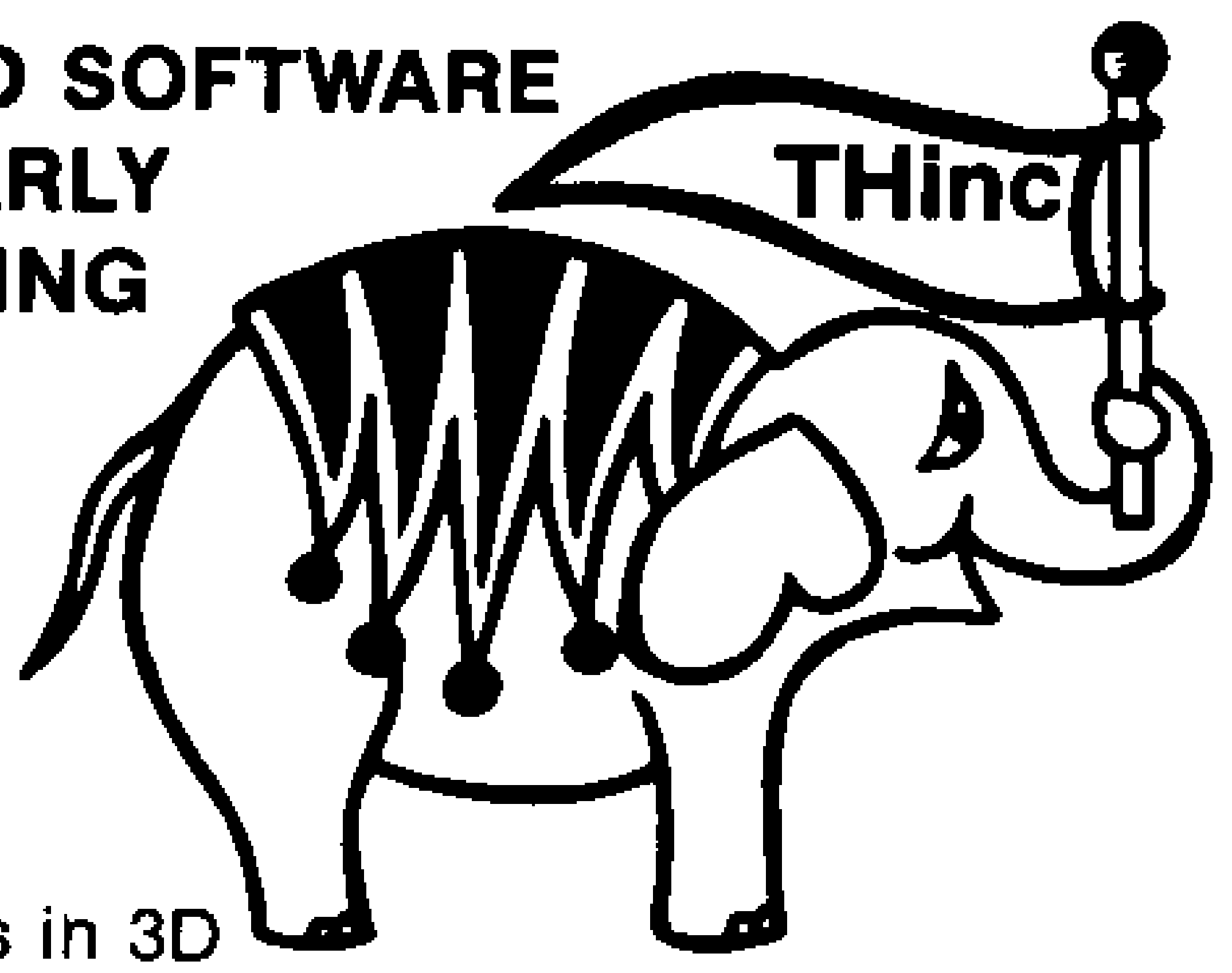

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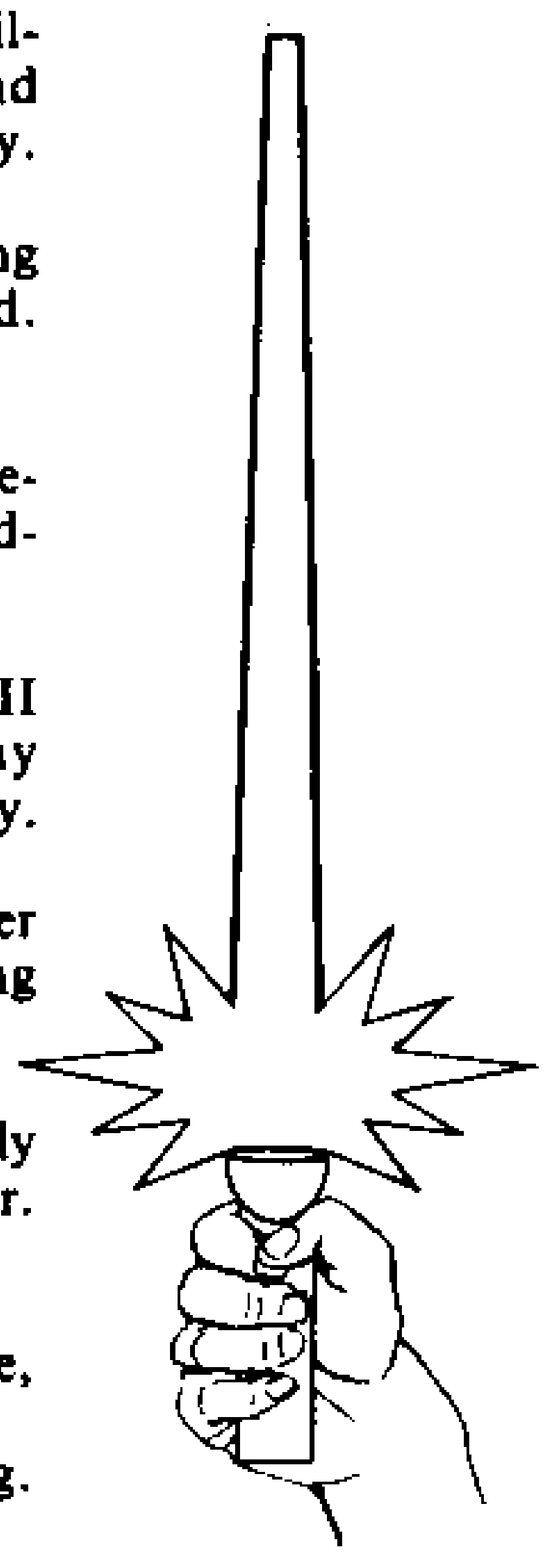

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Number Nibbler . . . from p. 63

```
380 FOR D=V1 TO 12 :: PRINT RPT
$(X$,28/LEN(X$)):: :: NEXT
 D :: A=16 :: NT=10 :: FOR
Z=V1 TO 10
390 FOR P=V1 TO 8 :: CALL COLOR
(P,A,NT):: CALL SCREEN(NT):
: NEXT P :: IF A=16 THEN A=
V2 :: NT=8 ELSE A=16 :: NT=
10
400 NEXT Z :: CALL COLOR(V1,B,B
):: CALL SCREEN(B):: IF CH=
1 THEN GOSUB 620 ELSE GOSUB
 1140
410 GOSUB 1730 :: CALL DELSPRIT
E(ALL):: NEXT W
420 CALL SAY("GOODBYE FOR NOW P
LAY AGAIN SOME TIME"):: STO
P
430 CALL COLOR(12,V2,B):: CALL
CHAR(120,"010101010101FFFFF
FFF010101010101808080808080
FFFFFFFF808080808080")
440 IF CH=3 THEN GOSUB 1590
450 CALL CHAR(124,"00000000007F
7F00007F7F00000000000000000
000FEFE0000FEFE")
460 PR=INT((J-V1)*RND+V1):: O=J
-PR :: IF CH=3 THEN PR=J
470 V=PR :: I=V0 :: GOSUB 790 :
: IF CH=3 THEN S=ST+3*PR-3*
(O+1):: H=3
480 CALL HCHAR(10+H,S,120):: CA
LL HCHAR(11+H,S,121):: CALL
 HCHAR(10+H,S+V1,122):: CAL
L HCHAR(11+H,S+V1,123):: S=
S+3
490 V=O :: IF CH=3 THEN H=3
500 LL=S :: I=V1 :: GOSUB 790 :
: GOSUB 910 :: CALL COLOR(1
4,10,10):: PL=7
510 I=V0 :: GOSUB 1710 :: IF X=
PR+48 THEN CALL HCHAR(20,7,
96):: GOTO 520 ELSE CALL SO
UND(500,131,V2):: GOTO 510
520 CALL SPRITE(#V1,ASC(STR$(PR
)),5,144,46):: CALL COLOR(1
0+I,CL,B)
530 IF CH=3 THEN J=PR-O
540 I=V1 :: PL=16 :: GOSUB 1710
 :: IF X=O+48 THEN CALL HCH
AR(20,16,96):: GOTO 550 ELS
E CALL SOUND(1000,131,V2)::
 GOTO 540
550 CALL SPRITE(#V2,ASC(STR$(O)
),5,144,118):: CALL COLOR(1
0+I,CL,B)
560 CALL COLOR(V1,V2,B):: IF CH
=3 THEN GOSUB 1600 :: GOTO
580
570 FL=V1 :: S=LL :: V=O :: I,H
=V0 :: GOSUB 790
580 I=V0 :: PL=25 :: GOSUB 1710
590 IF X=J+48 THEN CALL HCHAR(2
0,25,96):: GOTO 600 ELSE CA
LL SOUND(1000,131,2):: GOTO
 580
600 CALL SPRITE(#3,ASC(STR$(J)))
,5,144,190):: IF CH=3 THEN
GOSUB 1690 :: GOTO 370
610 N$=STR$(PR):: CALL SAY(STR$
(PR),,"AND",,STR$(O),,"IS",
,STR$(J)):: GOTO 370
620 CALL CLEAR :: GOSUB 900
630 NM=49 :: GOSUB 1730
640 CALL CHAR(128,"3C7EEFFFFFFF
7E3C",130,"3E7EECF8F8FC7E3E
"):: IF TL=V1 THEN 670
650 C=18-J :: FOR E=V1 TO J ::
CALL HCHAR(12,C,42):: D=ASC
(STR$(E)):: GOSUB 890
660 CALL SAY(STR$(E)):: C=C+V2
:: NEXT E :: RW=12
670 CO=15-J :: PT=V1 :: CALL SP
RITE(#10,128,13,8*(RW-3),25
,V0,10)
680 CALL SOUND(-10,880,V0):: CA
LL PATTERN(#10,129+PT):: CA
LL POSITION(#10,X,Y)
690 IF (Y>=240)OR(Y<=24)THEN 70
0 ELSE PT=-PT :: GOTO 680
700 IF TL=V1 THEN 180 ELSE CALL
LOCATE(#10,8*(RW-V1)-V2,25
)
710 CALL SOUND(-10,880,V0):: CA
LL PATTERN(#10,129+PT):: CA
LL POSITION(#10,X,Y):: IF A
BS(Y-8*CO)<=16 THEN 730
720 PT=-PT :: GOTO 710
730 FOR F=V1 TO J :: CALL MOTIO
N(#10,V0,V2):: D=ASC(STR$(F
))
740 CALL LOCATE(#10,8*(RW-V1)-V
2,8*CO+8):: CALL PATTERN(#1
0,128):: CALL SOUND(70,110,
V0):: CALL HCHAR(RW,CO+3,45
)
750 CALL SAY(STR$(F)):: CALL PA
TTERN(#10,130):: GOSUB 890
:: CALL HCHAR(RW+3,CO+3,NM)
:: NM=NM+V1
760 CO=CO+V2 :: NEXT F :: PT=V1
 :: CALL SPRITE(#10,128,13,
8*(RW-V1)-V2,8*CO+8,V0,10)
770 CALL SOUND(-10,880,V0):: CA
LL PATTERN(#10,129+PT):: CA
LL POSITION(#10,X,Y)
780 IF Y<240 AND Y>24 THEN PT=-
PT :: GOTO 770 ELSE CALL DE
LSPRITE(#10):: CALL CLEAR :
: RETURN
790 FOR R=V1 TO V :: CALL HCHAR
(10+H,S,104+12*I)
800 CALL HCHAR(11+H,S,105+12*I)
:: CALL HCHAR(10+H,S+V1,106
+12*I):: CALL HCHAR(11+H,S+
V1,107+12*I)
810 IF FL=V1 THEN 840 ELSE IF Q
Q=V2 THEN 830
820 FOR A=V0 TO 30 STEP 5 :: CA
LL SOUND(-99,T(R),A,2.756*T
(R),A,V2*T(R),A):: NEXT A :
: GOTO 840
```

Continued on p. 78

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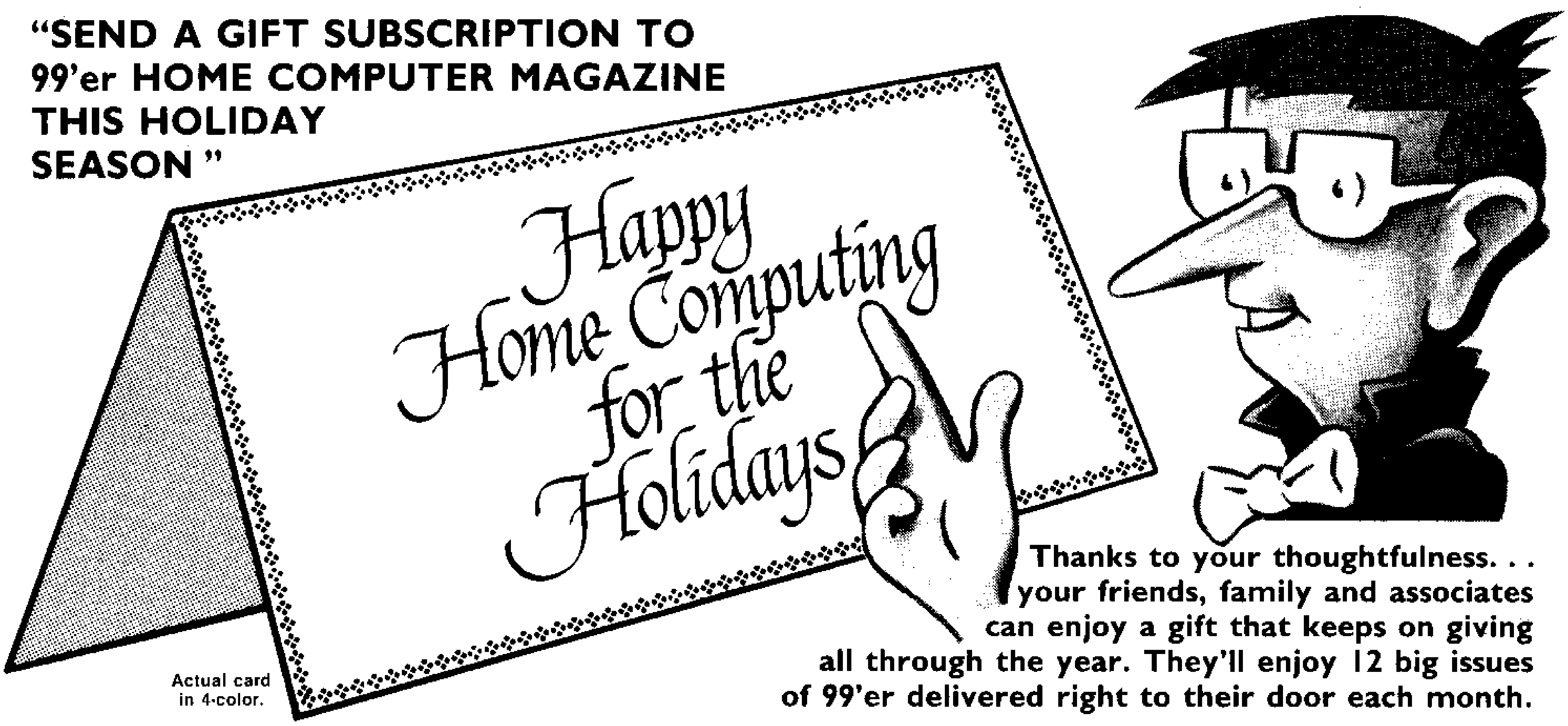
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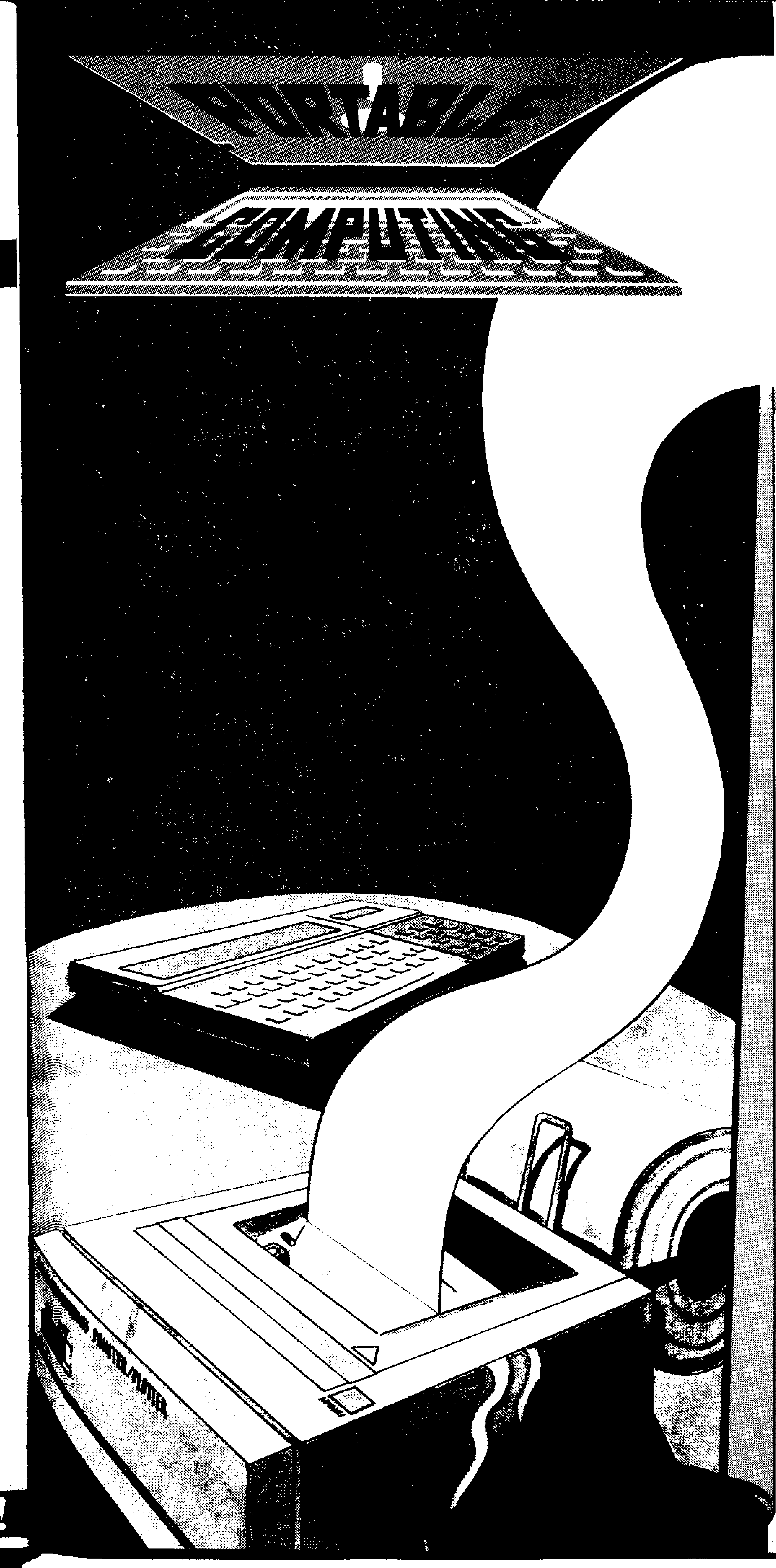

LOTS OF PLOTS

by Robert Ackerman
Managing Editor

To rephrase an old saw, a plot is worth a thousand numbers. When trying to grasp the relationships of one set of numbers to another, to see changes and rates of change, to appreciate the effect that an alteration in one variable has on another, it can be worthwhile to express them as ordered sets on paper—a graph. In that form, it's easy to see at a glance how costs have changed over a decade, how solubility changes with temperature, or how changes in population might affect energy demand.

One of the peripherals Texas Instruments has designed to accompany its Compact Computer 40 will allow you to plot those changes yourself. The HX1000 Four-Color Printer/Plotter is another of the system's portable components: It's small enough to fit in your briefcase and battery-powered to operate on its own, away from wall plugs. Like the rest of these peripherals, it is part of a modular, stackable system, which keeps the system's space requirements down. The Printer/Plotter sits on top of the stack—on the Wafertape™ drive or the RS232 Interface or other components. In terms of actual desktop space occupied by the peripherals, the stack takes up somewhat less space than a standard desk dictionary. There's a price to pay for this compactness, though: The Printer/Plotter uses adding-machine tape for its output. But with careful attention to the scales you use, you can still turn out informative plots.

The Printer/Plotter has two modes: graphics and text. In text mode, it works much like any other printer. The accompanying program listing was printed on the Printer/Plotter, using the text mode. (The symbol that looks like a cocktail glass or a cricket bat is really an exclamation point—Enhanced BASIC's tail remark symbol.) It is in the graphics mode that this peripheral shows its power. As relatively simple examples, both the headline type for this article and the plot in Figure 1 were printed on the Printer/Plotter in the graphics mode. To put the Printer/Plotter in the graphics mode, you first OPEN the device for output and then send it CHR$(19)—lines 120-130 in the accompanying program. Thereafter, the Plotter accepts either string expressions (line 530, for instance) or string variables (line 890) as commands. The print head moves either absolutely (in relation to an origin you've previously defined) or relatively (in relation to its present position). Depending on the command given, it will move only with the pen up or it will put a pen down and draw a line as it moves. In addition, you can specify any one of four pen colors for any line, and any one of ten different line types from solid to dotted. For instance, the statement in line 530 tells the plotter to draw a line from the present origin (0,0), using pen color 2 (blue) and a solid line (the default value), to a location 216 units away on the X-axis (216,0). In other words, the Plotter draws a solid blue line across the entire printable width of the paper.

Let's look at the PLOTTER subprogram to see how it uses a string variable. PLOTTER has six string variables in its parameter list (x1, y1, x2, y2, pen color and line type). It plots a line from (x1, y1) to (x2, y2), using the pen color and line type specified. Line 840 builds part of the string variable to command the print head to draw a line and adds the variables defining the first point, with the correct punctuation. Lines 850-870 check for pen color and/or line type; if none is specified, it uses either the current values or the default values: black and solid. Line 880 adds the variable defining the second point. Line 890 then prints the line segment specified in the string variable PLOT$.

You can also print characters in the graphics mode. Line 560 moves the pen, first to the right edge of paper using the "*M(x,y)*" command, and prints the character "1" using the "*T(characters)*"

Graph Plotter
Explanation of the Program

Line Nos.	
100	Title.
110	Send control to error routine.
120-130	Open plotter for output and set it to graphics mode.
140	Initialize PLOTTER subprogram variables. (They remain initialized between calls.)
150-160	Go to subroutine to label axes.
170-410	Calculate x and y coordinates for function X*TAN(X) and plot them.
170-190	Calculate function.
210-230	Process beginning of line segment.
240-320	Check for discontinuity.
330-370	Check for y-value out of bounds.
380	Set endpoints of line segment.
390	Call PLOTTER subprogram.
400	Begin new line segment, if discontinuous.
420-490	Calculate x and y coordinates for function SIN(X)/EXP(X)
500-510	End program.
520-680	Draw and label y-axis.
690-770	Draw and label x-axis.
780-810	Routine on error.
820-900	PLOTTER subprogram.

```
100 !Graph Plotter
110 ON ERROR 790
120 OPEN #1,"10",O
UTPUT
130 PRINT #1,CHR$(
19)
140 ATTACH PLOTTER
150 !Draw and Labe
l Axes
160 GOSUB 530
170 !Plot First Fu
nction: X*TAN(X)
180 FLAG=0:CONT=0:
C$="4":P$="0"
190 FOR X=0 TO 150
200 Y=X/10*TAN(X/1
0)
210 !Check for beg
inning of (discont
inuous) segment
220 IF FLAG=1 THEN
 250
230 X2$=STR$(INT(-
X*5)):Y2$=STR$(INT
(Y)):FLAG=1:CONT=0
:GOTO 410
240 !Check for dis
continuity
250 IF NOT (VAL(Y2
$)<-10 AND Y>10)TH
EN 290
260 FLAG=0:CONT=1
270 X1$=X2$:X2$=ST
R$(INT(-X*5))
280 Y1$=Y2$:Y2$="-
100":Y=100:GOTO 39
0
290 IF NOT (VAL(Y2
$)>10 AND Y<-10)TH
EN 340
300 FLAG=0:CONT=1
310 X1$=X2$:X2$=ST
R$(INT(-X*5))
320 Y1$=Y2$:Y2$="1
00":Y=-100:GOTO 39
0
330 !Check for Y o
ut of bounds
340 IF ABS(Y)<100
THEN 380
350 X1$=X2$:Y1$=Y2
$:X2$=STR$(INT(-X*
5))
360 IF Y>100 THEN
Y2$="100" ELSE Y2$
="-100"
370 GOTO 390
380 X1$=X2$:Y1$=Y2
$:X2$=STR$(INT(-X*
5)):Y2$=STR$(INT(Y
))
390 CALL PLOTTER(Y
1$,X1$,Y2$,X2$,(C$
),(P$))
400 IF CONT=1 THEN
 220
410 NEXT X
420 !Plot Second F
unction: SIN(X)/e^
(X/5)
430 FLAG=0:C$="3":
P$="4"
440 FOR X=1 TO 150
450 Y=SIN(X/10)/EX
P(X/50)
460 IF FLAG=0 THEN
 X2$=STR$(INT(-X*5
)):Y2$=STR$(INT(Y*
100)):FLAG=1:GOTO
490
470 X1$=X2$:Y1$=Y2
$:X2$=STR$(INT(-X*
5)):Y2$=STR$(INT(Y
*100))
480 CALL PLOTTER(Y
1$,X1$,Y2$,X2$,(C$
),(P$))
```

command; then it moves to the left edge of the paper and prints the characters "-1". Because line 550 gave the Plotter the commands "A1" and "C3", for angle and color respectively, the characters were printed rotated 90 degrees clockwise and in green. This feature makes it very easy for you to label your plots. The Plotter also gives you a choice of character sizes. The headline type for this article is character size 8, rotated 90 degrees clockwise.

> **"The stack of peripherals, with the Printer/Plotter on top, takes up somewhat less space than a standard desk dictionary."**

The program which plotted the type changed the pen color between letters of a word. To get the thickness required, it printed a word, returned to its starting point, moved over one unit and printed again, repeating that process until it reached the desired thickness.

The accompanying program uses a variety of commands to print the axes and their labels as well as the plots in Figure 1. As with all plots, these are approximations to the functions they represent. Here the functions are y=x tan x (solid red line) and y= (sin x)/e^x (dashed green line). Since the range of values for these functions is known, the plot scales were set before the program calculated any values. (The x-axis is in radians; the CC-40 must be set to process radians.) In other instances, however, you might want the program first to calculate all the values of the functions and store the x,y pairs in arrays and then search for the maximum value. The program could then use this maximum to set up the scale.

In this case, the scale for the sine function given ranges from -1 to 1 because it can never take on values outside that range. The tangent function is another matter, though: It can take on values from minus infinity to plus infinity. Since the Printer/Plotter is limited to a range somewhat smaller than this (216 units across the tape and 1998 along the tape), the program has to cope with values out of bounds. Lines 330-370 make this check and if the function value is out of bounds, it sets the value at 100 or -100. But beyond that, the tangent function is discontinuous. The last endpoint of one segment is plus infinity and the first endpoint of the next segment is minus infinity, but those points aren't connected by a line. To keep the Plotter from connecting those points, the program has to recognize those discontinuities. Lines 240-320 make this check, and if they discover a discontinuity, set two flags, FLAG and CONT. The check is for y1 positive and y2 negative or vice versa. FLAG tells the program if the current value is the first in a line segment; CONT tells the program not to calculate another value yet, but to use the present one.

All plotting programs have to cope with those three conditions: the constraints of scale, the possibility of func-

```
490 NEXT X
500 PRINT #1,"L(0,
-750):0,(1,-750)"
510 CLOSE #1:STOP
520 !Draw and Labe
l Y-axis
530 PRINT #1,"L(0,
0):2,(216,0)"
540 PRINT #1,"M(10
8,0)":PRINT #1,"O"
550 PRINT #1,"M(0,
0)":PRINT #1,"A1":
PRINT #1,"C3"
560 PRINT #1,"M(93
,-5)":PRINT #1,"T(
1)":PRINT #1,"M(-1
05,-5)":PRINT #1,"
T(-1)"
570 PRINT #1,"L(10
0,5),(100,-5)":PRI
NT #1,"L(-100,5),(
-100,-5)"
580 PRINT #1,"C4"
590 FOR I=-103 TO
93 STEP 20
600 II$=STR$(I+3):
PRINT #1,"L("&II$&
",5),("&II$&",-5)"
610 I$=STR$(I-5)
620 IF I<-100 THEN
 S$="55":GOTO 660
```

```
630 IF I<-3 THEN S
$="45":GOTO 660
640 IF I=-3 THEN S
$="25":GOTO 660
650 S$="35"
660 PRINT #1,"M("&
I$&","&S$&")":PRIN
T #1,"T("&II$&")"
670 NEXT I
680 PRINT #1,"M(93
,45)":PRINT #1,"T(
100)":PRINT #1,"L(
100,5),(100,-5)"
690 !Label X-axis
700 PRINT #1,"C2":
PRINT #1,"L(0,0),(
0,-750)"
710 PRINT #1,"C1"
720 FOR I=0 TO -75
0 STEP -50
730 I$=STR$(I):PRI
NT #1,"L(5,"&I$&")
,(-5,"&I$&")":PRIN
T #1,"M(-15,"&I$&"
)"
740 I$=STR$(-I/50)
:PRINT #1,"T("&I$&
")"
750 NEXT I
760 PRINT #1,"M(0,
0)"
770 RETURN
```

```
780 !Routine on er
ror
790 CALL ERR(CODE,
TYPE,FILE,LINE)
800 PRINT "ERROR "
;CODE;" TYPE ";TYP
E;" FILE ";FILE;"
IN LINE ";LINE:PAU
SE
810 CLOSE #1:STOP
820 !Plotter Subpr
ogram
830 SUB PLOTTER(PX
1$,PY1$,PX2$,PY2$,
PC$,PP$)
840 PLOT$="L("&PX1
$&","&PY1$&")"
850 IF PC$<>""THEN
 PLOT$=PLOT$&":"&P
C$
860 IF PC$=""AND P
P$<>""THEN PLOT$=P
LOT$&"::"&PP$
870 IF PC$<>""AND
PP$<>""THEN PLOT$=
PLOT$&":"&PP$
880 PLOT$=PLOT$&",
("&PX2$&","&PY2$&"
)"
890 PRINT #1,PLOT$
900 SUBEND
```

SPECTACULAR HOME COMPUTER GRAPHICS ANIMATION CONTEST

99'er HCM is looking for TI Home Computer programs that cross new computer graphics animation frontiers into uncharted territory. Some of the factors we are looking for in the submissions are:

- The graphics should show animated sequences such as vehicles crossing a bridge or a plane flying through a mountain pass.
- The graphics must be visually attractive.
- The animation sequence must last for at least 3 minutes duration and must be non-repetitive.
- The program should use a variety of random branching techniques as it passes through the animation sequence loop.
- The animation sequence may use any language that will run on the TI Home Computer (Forth, TI BASIC, Extended BASIC, LOGO, Assembly Language, . . .).

An official entry form must accompany each program that you submit. To request your entry submission form, call (503) 485-8796 or write to *99'er HCM* Graphics Animation Contest, 1500 Valley River Drive, Suite 250, Eugene, OR 97401. Submissions without an official entry form will not be accepted or acknowledged.

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tion values out of bounds, and the possibility of discontinuous functions. This program has a set scaling factor for each function, determined in advance. In the case of the tangent function, the routine that calculates the values also checks for values out of bounds and discontinuities. For other applications, it might be more useful to put these checks in the PLOTTER subprogram.

There are some other features to note about this program. The orders of the parameters in the statements that call the subprogram PLOTTER and the statement that defines it are different. This program actually plots the functions on their sides in order to get acceptable ranges of values on the axes. Therefore, it transposes the parameters when it passes them. The x-values in the calling statements become y-values in the defining statement, and the y-values in the calling statements become x-values in the defining statement.

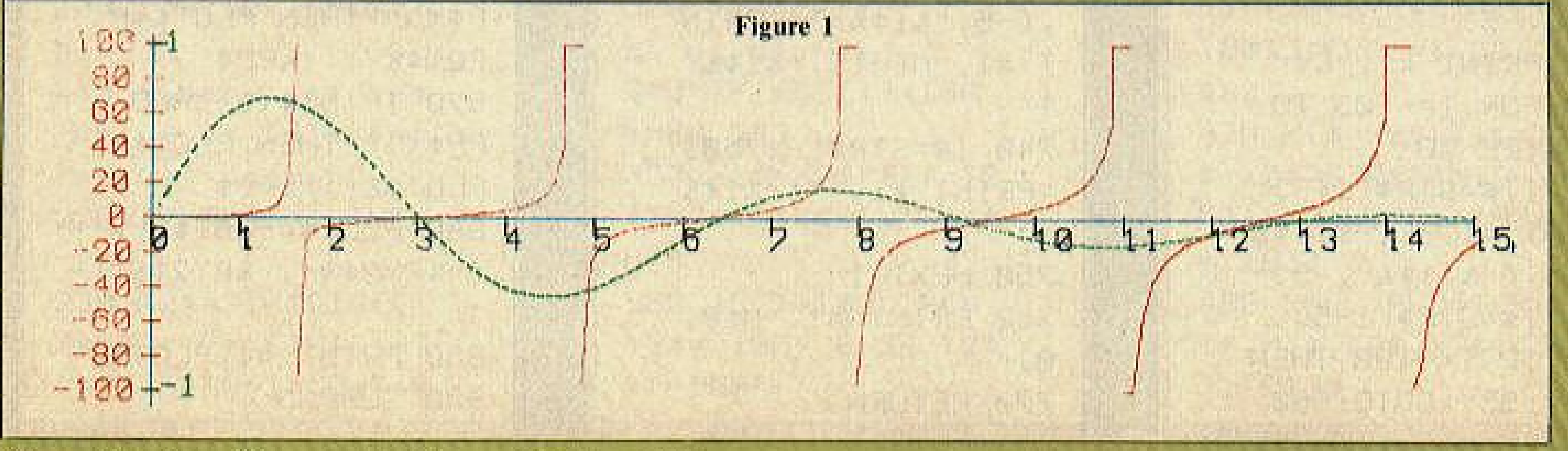
> **"You can specify any one of four pen colors, and any one of ten different line types from solid to dotted."**

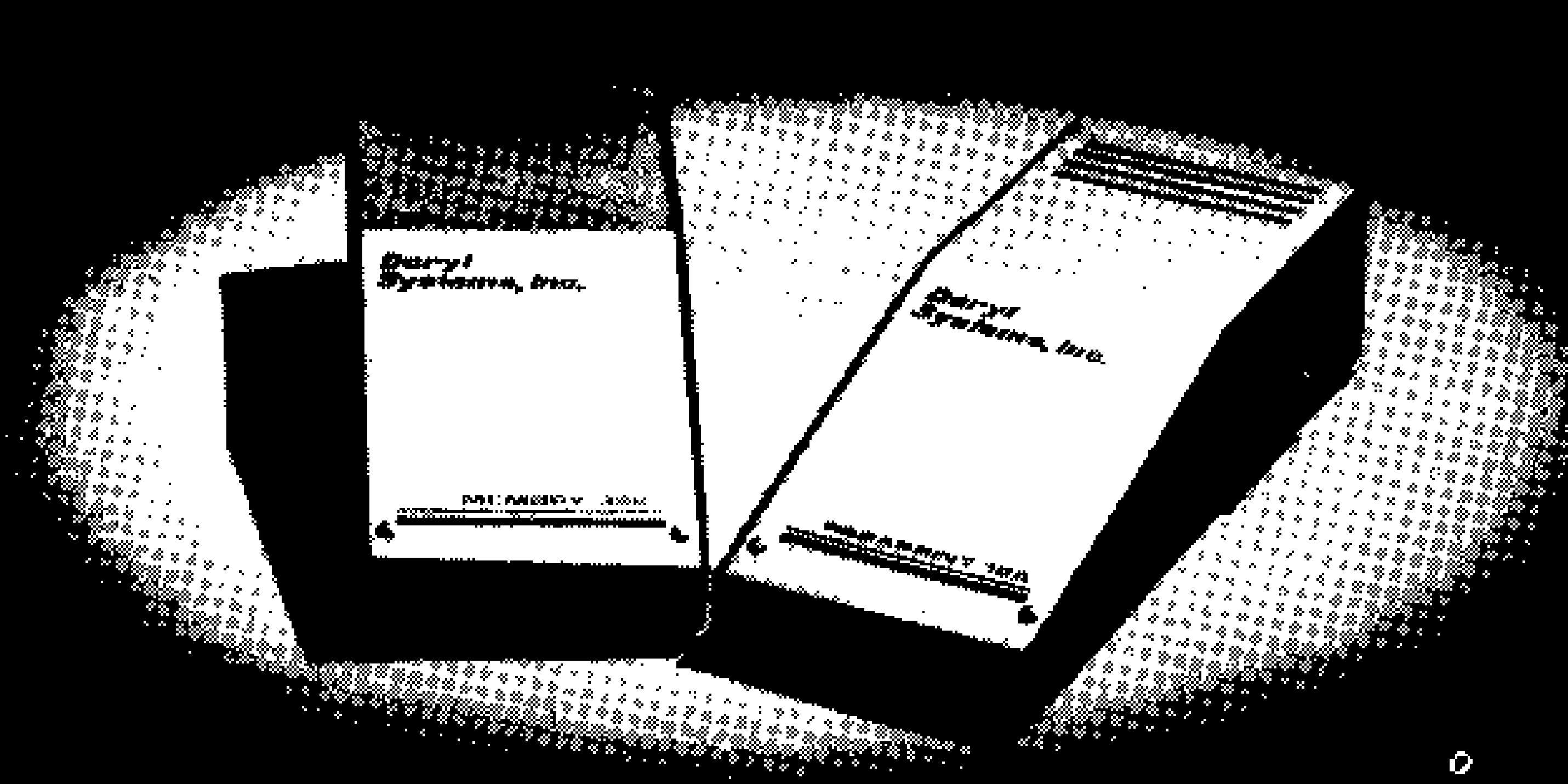
The program begins with an ON ERROR statement which transfers control to line 790 if the operating system detects an error in program execution. Line 790 calls the ERR subprogram, and line 800 displays the results on the CC-40's display. This is a *must* for debugging programs on the CC-40. Without it, you merely get an error message that specifies the *type* of error, but no hint as to *where* the error might have occurred. This routine allows you to pinpoint the problem.

Line 140 uses the ATTACH statement to attach the PLOTTER subprogram. This causes the variables used in the subprogram to be initialized once only, rather than every time the subprogram is entered. This speeds up program execution and is a useful technique if your program has the space to let the subprogram continually occupy some of it.

With the Printer-Plotter hooked up to the CC-40 and a program to plot out your numbers, you'll be able to see the relationships clearly.

Figure 1





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Tortoise Shell . . . from p. 54

```
TO ADVENTURE
INIT
PLAY
END

TO INIT
MAKE "DIRS [NORTH EAST SOUTH W
EST UP DOWN ]
MAKE "VERBS [TAKE DROP UNLOCK
OPEN ]
MAKE "WORDS [AX KNIFE KEY RING
 CHALICE GATE ]
MAKEALL BF TEXT "INFO
MAKE "PLACE "FOREST
MAKE "INVENTORY [ ]
CS
DISPLAY [ENJOY YOUR ADVENTURE!
 ]
DISPLAY [AT ANY TIME YOU CAN T
YPE HELP FOR OPTIONS. ]
END

TO PLAY
DESCRIBE
INTERPRET RL
IF DONE? REPORT STOP
PLAY
END

TO TAKE :OBJ
TEST MEMBER? :OBJ :INVENTORY
IFT DISPLAY SE [ALREADY HAVE ]
 :OBJ STOP
TEST MEMBER? :OBJ ITEMS :PLACE
IFF DISPLAY SE :OBJ [NOT HERE
] STOP
IF NOT BF :INVENTORY = [ ] THE
N DISPLAY [YOU MUST DROP SOMET
HING FIRST ] STOP
MAKE "INVENTORY SE :INVENTORY
:OBJ
REMOVE :OBJ :PLACE
END
```

```
TO DROP :OBJ
TEST MEMBER? :OBJ :INVENTORY
IFF DISPLAY SE [YOU DON'T HAVE
 ] :OBJ STOP
MAKE "INVENTORY SUBT :OBJ :INV
ENTORY
PUT :OBJ :PLACE
END

TO UNLOCK :IT
TEST MEMBER? :IT OPTS :PLACE
IFF DISPLAY [NOTHING TO UNLOCK
 ] STOP
TEST MEMBER? "KEY :INVENTORY
IFF DISPLAY ( SE [CAN'T UNLOCK
 ] :IT [WITHOUT A KEY ] ) STOP
REMOVE "LOCKED :IT
DISPLAY ( SE [THE ] :IT [IS UN
LOCKED ] )
END

TO OPEN :IT
TEST MEMBER? :IT OPTS :PLACE
IFF DISPLAY [NOTHING TO OPEN ]
 STOP
TEST MEMBER? "LOCKED ITEMS :IT
IFT DISPLAY ( SE [THE ] :IT [I
S LOCKED ] ) STOP
REMOVE "CLOSED :IT
DISPLAY ( SE [THE ] :IT [IS OP
EN ] )
END

TO MAKEALL :LS
IF :LS = [ ] THEN STOP
MAKE FIRST FIRST :LS BF FIRST
:LS
MAKEALL BF :LS
END

TO HELP
DISPLAY [YOU CAN GO ]
DISPLAY :DIRS
DISPLAY [OR ]
PRINT :VERBS
PRINT [AN OBJECT. ]
END
```

```
TO INTERPRET :L
IF :L = [HELP ] THEN HELP INTE
RPRET RL STOP
TEST MEMBER? LAST :L :DIRS
IFT GODIR LAST :L STOP
TEST BOTH MEMBER? FIRST :L :VE
RBS MEMBER? LAST :L :WORDS
IFT TAKEACTION FIRST :L LAST :
L STOP
PRINT [CAN'T UNDERSTAND ]
INTERPRET RL
END

TO INFO
FOREST [AX KNIFE ] [BRIDGE CLE
ARING CLIFF CLIFF [ ] [ ] ] [I
N A FOREST ]
BRIDGE [ ] [COURTYARD MOAT FOR
EST MOAT ] [ON A BRIDGE ]
CLIFF [ ] [ ] [FALLING OFF A C
LIFF! ]
CLEARING [KEY ] [[ ] [ ] HOME
FOREST ] [IN A CLEARING ]
HOME [ ] [ ] [HOME FROM YOUR J
OURNEY ]
MOAT [ ] [ ] [IN A DEEP MOAT!
]
COURTYARD [ ] [GATE [ ] BRIDGE
 ] [IN A COURTYARD BEFORE A MA
GNIFICENT CASTLE ]
GATE [LOCKED CLOSED ] [HALL [
] COURTYARD ] [GOING THROUGH A
N IRON GATE ]
HALL [RING ] [[ ] [ ] GATE [ ]
 STAIRS ] [IN A GREAT HALL ]
STAIRS [ ] [[ ] [ ] [ ] [ ] RO
OM HALL ] [ON A MARBLE STAIRS
]
ROOM [CHALICE ] [[ ] [ ] [ ] [
 ] [ ] STAIRS ] [IN AN EXQUISI
TE ROOM ]
KNIFE [A SHARP KNIFE ]
AX [A TRUSTY AX ]
KEY [A RUSTY KEY ]
RING [A GOLD RING ]
CHALICE [A GOLD CHALICE ]
END
```

Continued on p. 72

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PROFESSIONAL UTILITIES

Tortoise Shell . . . from p. 71

```
TO DONE?
OUTPUT MEMBER? :PLACE [HOME CL
IFF MOAT ]
END

TO DESCRIBE
CS
DISPLAY SE [YOU ARE ] DESCRIPT
 :PLACE
PRINT [ ]
TEST :INVENTORY = [ ]
IFF PRINT [YOU HAVE ] DESOBJS
:INVENTORY
TEST ITEMS :PLACE = [ ]
IFF PRINT [YOU SEE ] DESOBJS I
TEMS :PLACE
IF NOT DONE? THEN PRINT [THERE
 IS A ]
DESOPTS :DIRS OPTS :PLACE
END

TO REPORT
DESCRIBE
TEST MEMBER? :PLACE [CLIFF MOA
T ]
IFT DISPLAY [YOU ARE IN BIG TR
OUBLE! ] STOP
TEST MEMBER? "CHALICE :INVENTO
RY
IFT DISPLAY [YOU WILL LIVE A L
ONG LIFE. ]
IFF DISPLAY [NEXT TIME BRING T
HE CHALICE ]
END

TO REMOVE :OBJ :PLACE
MAKE :PLACE FPUT SUBT :OBJ ITE
MS :PLACE BF THING :PLACE
END

TO SUBT :OBJ :SET
IF :SET = [ ] THEN OUTPUT :SET
TEST :OBJ = FIRST :SET
IFT OUTPUT BF :SET
OUTPUT FPUT FIRST :SET SUBT :O
BJ BF :SET
END
```

```
TO PUT :OBJ :PLACE
MAKE :PLACE FPUT SE ITEMS :PLA
CE :OBJ BF THING :PLACE
END

TO ITEMS :P
OUTPUT FIRST THING :P
END


TO DISPLAY :L
PRINT [ ]
PRINT :L
WAIT 120
END

TO OPTS :P
OUTPUT FIRST BF THING :P
END

TO GODIR :DIR
MAKE "NEWPLACE MATCH :DIR :DIR
S OPTS :PLACE
TEST :NEWPLACE = [ ]
IFT DISPLAY SE [CAN'T GO ] :DI
R STOP
TEST MEMBER? :NEWPLACE [GATE S
TAIRS ]
IFF MAKE "PLACE :NEWPLACE STOP
TEST ITEMS :NEWPLACE = [ ]
IFF DISPLAY FIRST ITEMS :NEWPL
ACE STOP
DISPLAY SE [YOU ARE ] DESCRIPT
 :NEWPLACE
MAKE "PLACE :NEWPLACE
GODIR :DIR
END

TO TAKEACTION :VERB :OBJ
MAKE "OBJ SE :OBJ [ ]
RUN SE :VERB [FIRST :OBJ ]
END

TO MEMBER? :X :L
IF :L = [ ] THEN OUTPUT "FALSE
IF :X = FIRST :L THEN OUTPUT "
TRUE
OUTPUT MEMBER? :X BF :L
END
```

```
TO DESCRIPT :P
OUTPUT LAST THING :P
END

TO DESOBJS :L
IF :L = [ ] THEN PRINT [ ] STO
P
PRINT FIRST THING FIRST :L
DESOBJS BF :L
END

TO DESOPTS :DIRS :PLACES
IF :DIRS = [ ] THEN PRINT [ ]
STOP
MAKE "DIR FIRST :DIRS
TEST FIRST :PLACES = [ ]
IFT DESOPTS BF :DIRS BF :PLACE
S STOP
TEST MEMBER? :DIR [UP DOWN ]
IFT PRINT (SE FIRST :PLACES [
GOING ] :DIR )
IFF PRINT (SE FIRST :PLACES [
TO THE ] :DIR )
DESOPTS BF :DIRS BF :PLACES
END

TO MATCH :X :XS :YS
IF :XS = [ ] THEN OUTPUT [ ]
IF :X = FIRST :XS THEN OUTPUT
FIRST :YS
OUTPUT MATCH :X BF :XS BF :YS
END
```

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Make Your Mark . . . from p. 26

```
2620 PRINT "IF YOU WANT TO ERASE
      ANY ":"THING YOU HAVE DRAW
     N, SIMPLY":"PRESS '2.' EVE
     N IF YOUR"
2630 PRINT "PEN IS 'UP', IT WILL
      BECOME":"AN ERASER. WHEN Y
     OU MOVE IT,":"IT WILL ERASE
      EVERYTHING IT"
2640 PRINT "TOUCHES. TO STOP ER
     ASING.":"PRESS '2' AGAIN, O
     R PRESS":"'1' TO PUT THE PE
     N IN THE"
2650 PRINT "'UP' POSITION.":"WHE
     N THE PEN IS ERASING, IT":"
     LOOKS LIKE THIS:";CHR$(37)
2660 PRINT ::"[PRESS ANY KEY TO
     GO ON]"
2670 CALL HCHAR(20,19,37)
2680 CALL HCHAR(20,19,38)
2690 CALL KEY(0,K,S)
2700 IF S=0 THEN 2670
2710 CALL CLEAR
2720 PRINT "AT ANY TIME, YOU MAY
      MAKE":"THE PEN DISAPPEAR S
     IMPLY BY":"PRESSING '3.' T
     HIS WILL"
2730 PRINT "MAKE THE PEN DISAPPE
     AR,":"EVEN IF IT IS 'UP' OR
      IN THE":"ERASE MODE. TO M
     AKE THE PEN"
2740 PRINT "REAPPEAR, PRESS '3'
     AGAIN.":"THE PEN WILL COME
     BACK IN":"THE SAME MODE IT
     WAS IN WHEN"
2750 PRINT "YOU MADE IT DISAPPEA
     R.":"WHILE IT IS INVISIBLE,
     ":"NO OTHER KEY BUT '3' WIL
     L"
2760 PRINT "HAVE ANY EFFECT."
2770 PRINT :"REMEMBER, YOU CAN G
     O FROM":"'UP' TO 'ERASE' AN
     D FROM":"'ERASE' TO 'UP' AT
      ANY TIME."
2780 PRINT ::"[PRESS ANY KEY TO
     CONTINUE]"
2790 CALL KEY(0,K,S)
2800 IF S=0 THEN 2790
2810 CALL CLEAR
2820 PRINT "YOU MAY ERASE THE EN
     TIRE":"SCREEN AT ANY TIME B
     Y PRESS-":"ING [ENTER]. TH
     IS WILL"
2830 PRINT "CLEAR THE SCREEN AND
      ALLOW":"YOU TO START AFRES
     H.":"YOU MAY CHANGE THE CO
     LOR OF"
2840 PRINT "THE SCREEN BY PRESSI
     NG '.'":"IF YOU HOLD IT DOW
     N, THE":"SCREEN WILL CYCLE
     THROUGH"
2850 PRINT "ALL THE AVAILABLE C
     OLORS.":"YOU MAY CHANGE TH
     E COLOR":"OF YOUR PEN BY PR
     ESSING"
2860 PRINT "','.  IF YOU HOLD TH
     IS KEY":"DOWN, YOUR PEN WIL
     L":"CYCLE THROUGH ALL THE A
     VAIL-"
2870 PRINT "ABLE COLORS.":"[PRE
     SS ANY KEY TO CONTINUE]"
2880 CALL KEY(0,K,S)
2890 IF S=0 THEN 2880
2900 CALL CLEAR
2910 PRINT "YOU MAY CHANGE YOUR
     PEN'S":"SHAPE BY PRESSING [
     SPACE].":"BY HOLDING THIS K
     EY DOWN,"
2920 PRINT "YOU MAY CYCLE THROUG
     H ALL":"THE AVAILABLE SHAPE
     S.":"THERE ARE EIGHT SHAPE
     S:"
2930 PRINT
2940 FOR I=0 TO 4 STEP 4
2950 FOR J=128 TO 131
2960 PRINT CHR$(I+J);"    ";
2970 NEXT J
2980 PRINT ::
2990 NEXT I
3000 PRINT ::"[PRESS ANY KEY TO
     GO ON]"
3010 CALL KEY(0,K,S)
3020 IF S=0 THEN 3010
3030 CALL CLEAR
3040 PRINT "YOU MAY MOVE THE PEN
      USING":"EITHER THE JOYSTIC
     K OR THE":"ARROW KEYS. IF
     YOU USE THE"
3050 PRINT "ARROW KEYS, YOU MAY
     ALSO USE":"'W', 'R', 'Z', A
     ND 'C' FOR":"THE DIAGONALS.
     "
3060 PRINT :"IT IS EASIER TO MOV
     E ON THE":"DIAGONALS USING
     THE ARROW":"KEYS, BUT IT IS
      YOUR CHOICE."
3070 PRINT "DO YOU WANT TO USE T
     HE":"JOYSTICKS? (Y/N)"
3080 CALL KEY(3,K,S)
3090 IF S=0 THEN 3080
3100 IF K=78 THEN 3140
3110 IF K=89 THEN 3170
3120 PRINT "'Y' OR 'N' PLEASE."
3130 GOTO 3080
3140 STICK=0
3150 JOYS$="ARROW KEYS"
3160 GOTO 3260
3170 STICK=1
3180 PRINT ::"PRESS THE FIRING B
     UTTON ON":"THE JOYSTICK YOU
      WANT TO":"USE."
3190 FOR I=1 TO 2
3200 CALL KEY(I,K,S)
3210 IF K=18 THEN 3240
3220 NEXT I
3230 GOTO 3190
3240 SIDE=I
3250 JOYS$="JOYSTICK "&STR$(SIDE)
3260 CALL CLEAR
3270 PRINT "REMEMBER:":"'1' TO L
     IFT AND LOWER PEN.":"'2' T
     O ERASE OR DRAW AGAIN."
3280 PRINT :"'3' TO MAKE THE PEN
      DIS-":"APPEAR AND REAPPEAR
     .":"[ENTER] TO ERASE THE W
     HOLE":"SCREEN."
3290 PRINT "'.' TO CHANGE THE SC
     REEN COLOR.":"',' TO CHANG
     E PEN COLOR.":"[SPACE] TO
     CHANGE YOUR PEN"
3300 PRINT "SHAPE."
3310 PRINT :"USE ";JOYS$:"TO MOVE
      YOUR PEN."
3320 PRINT :"[PRESS ANY KEY TO S
     TART]"
3330 CALL KEY(3,K,S)
3340 IF S=0 THEN 3330
3350 IF STICK=0 THEN 3380
3360 PRINT ::"CHECK THE ALPHA LO
     CK"
3370 CALL SOUND(200,440,5)
3380 PRINT :::"NOW EXCUSE ME WHI
     LE I GET":"SET UP."
3390 RETURN
3400 END
```

Wizard's Keep . . . from p. 43

```
2040 DISPLAY AT(24,5):"ANOTHER G
     AME? Y OR N"
2050 CALL KEY(0,KY,ST):: IF KY<>
     89 AND KY<>78 THEN 2050
2060 IF KY=78 THEN CALL CLEAR ::
      STOP ELSE R=1 :: CALL SCRE
     EN(5):: GOTO 450
2070 CALL SOUND(500,165,1):: CAL
     L SOUND(999,110,1):: CALL S
     CREEN(2)
2080 CALL COLOR(11,7,1,12,7,1,13
     ,7,1,14,7,1):: CALL SOUND(2
     00,-5,1)
2090 CALL SCREEN(5):: CALL COLOR
     (11,16,1,12,1,1,13,1,1,14,1
     ,1):: X=R :: GOSUB 1960 ::
     RETURN
2100 REM DATA
2110 DATA 1,2,20,6,20,2,20,7,4,3
     ,1,2,4,4,4,4,15,21,15,20,6,
     20,6,20,7,8,7,3
2120 DATA 3,7,8,9,14,14,4,14,10,
     10,15,6,11,6,16,11,7,12,11,
     12,8,13,18,13
2130 DATA 13,14,14,14,15,10,5,15
     ,10,11,16,16,17,12,17,17,19
     ,17,19,19
2140 DATA 19,19,19,19,20,6,1,20,
     20,20,20,20,997
2150 DATA GEM,10,ROCK,2,AMULET,1
     0,LAMP,12,BOTTLE,8,3,9,18,5
     ,4,19
```

CORRECTION

In "Peripheral Visions," our review of hardware products in September (page 8), we dropped a digit on the price of the Foundation 32K memory expansion card. It should have read $150.00, not $50.00. We sincerely regret any inconveniences this may have caused.

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Excerpts from the

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of news & happenings in the Home Computer world

SIERRA ON-LINE COMES ON-LINE WITH TI

Sierra On-Line, Inc. is the latest third-party software house to join the TI cartridge bandwagon with *Jawbreaker*, its popular arcade-style video game. As in other similar agreements, TI will manufacture and distribute the software. Other packages are expected to follow in early 1984.

ATARI EYES HC SOFTWARE MARKET AS INDUSTRY WATCHES

Atari's CES-announced line of game cartridge software for other manufacturers' home computers (including Apple, IBM, Commodore, and Texas Instruments) may be more trouble than it's worth--if indeed it materializes at all. The across-the-board publishing venture is potentially risky and could backfire, hurting sales of Atari computers and videogames. In a massive effort to get products out, some designers reportedly have 6 weeks or less to do conversions of hit games--that if done carefully would normally take six months or more. Analysts fear that rushed conversions won't implement special machine features and will prove to be significantly less than state-of-the-art.

MEMORY AND MASS STORAGE--THE KEYS TO PRODUCTIVITY

Task-accomplishing software such as word processing, accounting, budgeting, database, spreadsheets, business graphics, and communications are increasingly being developed as integrated packages for ease of use, speed, and versatility. Interconnecting the formerly separate programs so that data can be shared and manipulated without cumbersome disk swapping and frustrating waiting periods during repetitive program loads requires that home and personal computers have larger amounts of addressable memory and greater density disk storage. Development time and investment is so much greater for integrated packages that operating systems which foster multiple-machine environments for a potentially larger market will be favored by developers. Digest analysts expect to see the UCSD p-System make a surprise comeback.

MILTON BRADLEY ANGRY AT ATARI'S "NO EXPANSION" DECISION

MB's "limited-time lost window of opportunity" is the basis of its recently filed multi-million dollar lawsuit against Atari. The VCS 2600 game machine manufacturer allegedly backed out of its intended large purchase of the MBX expander peripheral. [See August 99'er Digest for related news item.] The TI Home Computer's effective lead in speech recognition capability as provided by the MBX has been stretched that much longer by the Atari pull-out. The TI-marketed units should finally be appearing on November retail shelves.

WILL TI GET M*A*S*HED BY FOX PRICE CUT?

Although the video game cartridge M*A*S*H has been a best seller for Fox Games on Atari's VCS machine, the publisher has had to slash the cartridge's SRP of $29.95 down to $14.95--due to the arrival of lower-priced Atari cartridge closeouts. In a few locations, the popular Korean-War game has been seen selling for under $7. Analysts wonder what the effects of all this discount activity will be on the sales of the TI-licensed/marketed cartridge when it appears with its standard $39.95 SRP.

HARDWARE MANUFACTURERS EXPECTED TO LEARN FROM THIRD-PARTY HOUSES

Overstocked summer retail shelves were full of software published/distributed by hardware manufacturers. Third-party wares were significantly absent from the product glut. Manufacturers of HCs haven't been purging their software product lines, as do successful third-party vendors. Instead, they have been bombarding retailers with increasingly larger catalog and price sheets with new title additions rather than weeding out older titles and selling off programs after they peak. Hardware manufacturers will be forced into adopting the survival tactics of smaller firms so as to make room on retail shelves for their more sophisticated--and thus, more competitive--offerings.

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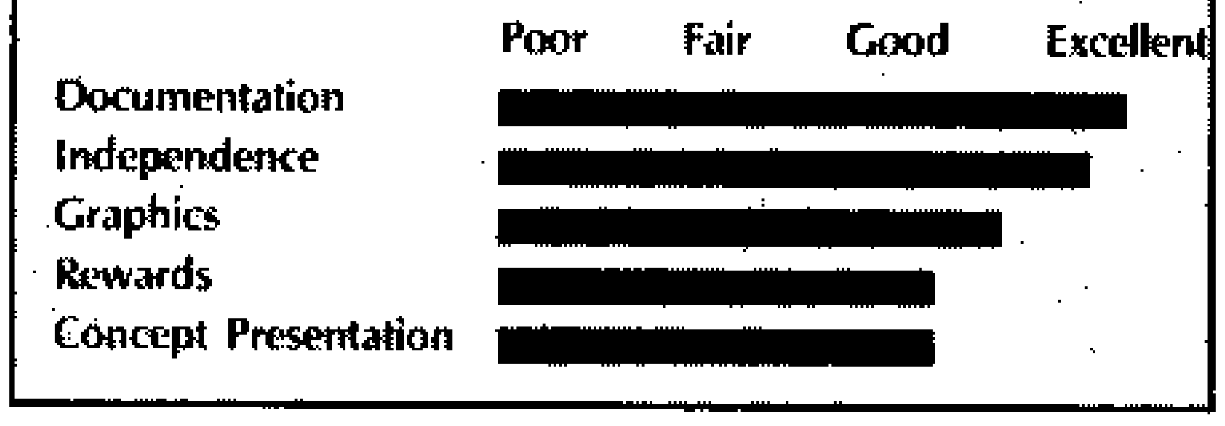
HANGMAN

A Module for All Reasons

A Review by Sharyn Lyon

99'er HCM Staff

Name: **Hangman**
Developer: **Milton Bradley Co.**
Program Type: **Education**
Distributor: **Texas Instruments, Inc.**
Price: **$19.95**



What's that up there on the screen? Is it Entertainment? Is it Education? It's *Hangman*! True enough, at first glance it's hard to tell. TI's mild-mannered *Hangman* Command Cartridge (developed by Milton Bradley) *looks* like just another entertaining game, and with its music, multi-color graphics and various levels, *Hangman* does provide an addicting scenario that will appeal to all ages. It is, however, much more than just a game. Beneath *Hangman's* just-for-fun exterior is a program loaded with educational potential.

The game has an ominous beginning: To the tune of Alfred Hitchcock's jauntily eerie theme song (*Funeral March for A Marionette* by Charles Fancois Gounod), the computer builds the scaffold, hangs the man, and then gives you the big news - you have only eleven chances to guess the word, or else the same thing will happen to you. You're on your own after four quick decisions: 1) Will you brave the game alone or with another player? 2) Do you want to read the Rules? 3) Will you play the Regular or Scrambled game? and 4) Do you want a maximum word length of 5 to 9 letters or a Custom List?

In many ways the game is just like the Hangman you used to play in school, complete with a low pitched "Uh-uh" if you guess the wrong letter. There are, however, important differences between this *Hangman* and the old pencil and paper version. For example, you used to need a live opponent. In this electronic version you can compete with another person, or you can opt to play against the computer in a number of different ways.

The Regular Game proceeds just like the pencil and paper version, with two playing options: you can either use the preprogrammed list or create your own Custom List of up to 60 words. Setting up the Custom List is simple it is well explained in the documentation, and you do not even need an external storage device although you will need a cassette recorder if you wish to save your lists.

A Multi-Age Challenge

As a teacher, I have used the Custom List extensively with youngsters in our tutorial program. Preschoolers learn from ENTERing their names, names of family members, and ABC's (12 letters maximum at one time on the Custom List mode). School-age children can type in words from reading books, spelling lists, science vocabulary, or even foreign languages. The Custom List allows the user to make good use of the program's educational applications.

What's the Meaning of This?

Players: 1 Lister and 2 Decoders or
1 Lister and 2 Teams of Decoders
(equal number on the teams)

Object of the Game: To complete the word first and to guess the real meaning of that word.

How To Play:

The Lister looks in the dictionary for two words (one for each team) whose meanings are unknown to both groups and ENTERs the words for Player 1 and Player 2 on the EACH ENTER WORD mode. Play *Hangman* (2 player game) as usual. If playing with teams, members decide together which letter to guess each time. When the word is complete, each person on the winning team makes up a meaning for his/her word and tells it to the Lister. The Lister then repeats all the "definitions," including the one in the dictionary. The members of the opposing team each take one turn to guess which meaning is the real one. The first team member to guess correctly gets to be the new Lister. If no one guesses the right definition, the team that finished their word first picks a Lister from their team. The former Lister joins that team for the next round.

Scoring:
+ 1 point to the team that finishes first, plus a point for each guess they had left when their word was complete.
+ 1 point to the team if they guess the correct meaning.
− 1 point if no one guesses the correct meaning.
Winning: the team to reach 20 points first wins.

If you choose not to enter a Custom List, you will find the preprogrammed list of words extensive and varied. You can choose a word as short as five letters and as long as nine letters. The five-letter words were just right for our preschoolers and kindergarteners, who enjoyed finding the letters on the keyboard and the way the computer responded when they pressed the right letter. Also, the ABC's are printed on the screen in large type, so that 3- and 4-year olds have no trouble identifying the letters. The children seemed to have fun whether they got "hung" or guessed the word. And they picked up a basic but important concept from using this game: that letters when joined together make meaningful message units called "words."

Older children and adults who played *Hangman* found their fun in using all the word-building clues they could think of to guess the word before their eleven chances were up. They went through their repertoire of decoding skills, employing both sight and phonetic word attack techniques. They even made heady observations about the structure of language as they played. One student, for example, observed that E is the most common vowel in French!

Two Heads Are Better

When two children play *Hangman* together, the educational advantages become even more clear. A strong point of the game is its versatility and adaptability. The two players need not be of the same age, ability, or interest level in order to play *Hangman* together. If one player wants to use the Custom List and the other does not, the program will allow it. For example, if one player is six and another is sixteen, the word each must guess can be selected at a level to challenge both. The six-year-old's word may be *mirror*, while the sixteen-year-old's word could be *minuscule*. The program does this by letting the players choose their playing styles twice. The first choice looks like this:

GUESS SAME WORD PRESS 1
GUESS DIFFERENT WORD PRESS 2
EACH ENTER WORD PRESS 3

In the two-player game above, the students would have pressed 3 and taken turns ENTERing words for the other player to guess. The EACH ENTER WORD option is similar to the Custom List already mentioned except that each player enters one word at a time. The Custom List mode allows you to enter up to 60 words in succession. If you press

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either 1 or 2, the next screen will present another choice:

```
HOW MANY LETTERS?
  PUSH 5 TO 9
  PUSH C FOR CUSTOM LIST
```

After Player 1 makes his decision, Player 2 may select a different option: the Custom List, for example, instead of the 9-letter preprogrammed words for which his opponent opted. In this way, even the most word-wise player will find a level to challenge him or her.

Mix and Fix

The Scrambled Game adds yet another level of difficulty, and, naturally, the longer the word, the harder it is to guess. The program displays the correct letters *in the order in which you guess them.* If you use the popular method of guessing all the vowels first, you will get the following display for the word "instruments" after 3 correct guesses and 2 incorrect:

```
EIU__________
```

Not much help, is it? You would have only 6 trials left to figure out what the word is. If you get stuck, you may want to use up 3 guesses to buy a letter. If you fill in all the blanks and you still don't know the word—don't worry—the computer quickly unscrambles it for you. In fact, the unscrambling may be too quick for those who would enjoy the challenge of figuring the word out for themselves. To combat this, we placed a piece of black construction paper over the letters on the screen before the last letter was ENTERed. This way we could make a new game out of seeing who could unscramble the word first.

The program does have a few other drawbacks. The *Hangman* title screen that asks, 1 OR 2 PLAYERS? does not wait long enough for your answer. If you wait for the song to end, the demonstration game will begin whether you want to see it or not. Another inconvenience in the program is that you cannot go back to the previous screen to change a detail such as the number of letters in your word. You must always return to the title screen first.

On the other hand, one of the most delightful aspects of *Hangman* is that nearly everyone will feel comfortable playing it. The game has something to offer, whether you are a 3-year-old playing with letters, a teacher wanting to use it in your classroom, or a parent anxious to spend some quality time with your youngster. The game plays enough like its pencil and paper predecessor, and the documentation is so good, that even someone who is terrified of computers will see the possibilities (recreational and educational) inherent in *Hangman*. Besides trying some of the suggested additional challenges mentioned in the documention, like putting a time limit on the game, you may find yourself devising your own variations. One such variation is reprinted here to get you started. *What's the Meaning of This?* uses *Hangman* and an adaptation of the Dictionary Game to help players (children and adults alike) learn new words and expand their vocabularies on their own levels.

One thing that holds true, whether you use *Hangman* for entertainment or educational purposes, is that you can spend hours playing it. You may find that when you finally do stop playing, visions of letters are still dancing in your head. As they do, however, you may notice that they appear in likely combinations. You and your youngsters will begin to make discoveries together like: Where there's a Q, there is likely to be a U. You will discover this and other spelling "rules" yourselves. TI has passed to us a way to pass on better knowledge of the language to our children while ushering a time tested game into the computer age. B _ A__O (BRAVO)!

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Number Nibbler . . . from p. 65

```
830 CALL SOUND(-250,T(R),9,2.02
    *T(R),9,1.01*T(R),7)
840 S=S+3 :: NEXT R :: FL,H=V0
     :: RETURN
850 RESTORE 860 :: FOR NT=V1 TO
     33 :: READ TM,TA :: CALL S
    OUND(TM,TA,7,V2*TA,5,3*TA,8
    ,-V1,27):: NEXT NT :: RETUR
    N
860 DATA 500,392,500,330,500,26
    2,250,262,250,294,250,330,5
    00,392,500,330,500,262,500,
    392,500,330,250,262
870 DATA 250,262,500,294,500,33
    0,500,370,500,392,750,440,2
    50,392,250,440,250,466,250,
    440,250,392,250,330
880 DATA 250,294,250,294,250,33
    0,250,349,250,330,250,294,2
    50,392,250,392,750,392
890 CALL SPRITE(#V1,D,5,144,126
    ):: RETURN
900 CALL COLOR(12,16,16):: CALL
     CHAR(120,"0"):: FOR X=18 T
    O 21 :: CALL HCHAR(X,15,120
    ,5):: NEXT X :: RETURN
910 CALL COLOR(12,V2,B):: CALL
    COLOR(9,15,16):: CALL CHAR(
    96,"0"):: FOR X=18 TO 21 ::
     CALL HCHAR(X,6,96,3):: NEX
    T X
920 CALL HCHAR(19,11,120):: CAL
    L HCHAR(20,11,121):: CALL H
    CHAR(19,12,122):: CALL HCHA
    R(20,12,123)
930 FOR X=18 TO 21 :: CALL HCHA
    R(X,15,96,3):: NEXT X
940 CALL HCHAR(19,20,124):: CAL
    L HCHAR(20,20,125):: CALL H
    CHAR(19,21,126):: CALL HCHA
    R(20,21,127)
950 FOR X=18 TO 21 :: CALL HCHA
    R(X,24,96,3):: NEXT X :: RE
    TURN
960 RESTORE 1050 :: RETURN
970 RESTORE 1060 :: RETURN
980 RESTORE 1070 :: RETURN
990 RESTORE 1080 :: RETURN
1000 RESTORE 1090 :: RETURN
1010 RESTORE 1100 :: RETURN
1020 RESTORE 1110 :: RETURN
1030 RESTORE 1120 :: RETURN
1040 RESTORE 1130 :: RETURN
1050 DATA 2,7,0103030103070F1B,1
    B030303060C0C0E,80C0C080C0E
    0F0DC,CCC0C0C060303038
1060 DATA 7,9,0F0E0F0F0F0C0F0F,0
    F0F0F0F0C0C0C0E,C0C0C0C0800
    0C0E0,E0C0C0C0C0C0C0E0
1070 DATA 16,15,0000000103070F1F
    ,3F7F7F0000FF7F3F,0040C0C0E
    0E0E0E0,E0E0E04040FFFEFC
1080 DATA 6,2,0000070F1931313F,7
    FFFFFFFFF303000,0000FEFFFFF
    FFFFF,FFFFFFFFFF0C0C00
1090 DATA 9,7,01071F7FFF3F3F31,3
    1313931313171FF,80E0F8FEFFF
    CFCCC,CCCCFCFCFCFCFEFF
1100 DATA 7,9,007F0404047C5457,D
    7FF7F7F783000000,00FE6262626
    262FE,FFFFFEFE1E0C0000
1110 DATA 5,2,7F7F6363637F7F7F,7
    FFFFF7F7B310000,0000001E1E0
    C0CFF,FFFFFFFCF8600000
1120 DATA 14,6,030F1F1F3F3F3F3F,
    1F1F0F0300000000,C0F0F8F8FC
    FCFCFC,F8F8F0C080804020
1130 DATA 5,2,000100010080403F,3
    F40800001000100,0080C0E0307
    818FF,FF187830E0C08000
1140 IF CH=V2 THEN Z=V0 ELSE Z=V
    2
1150 CALL CHARPAT(43+Z,P$):: CAL
    L COLOR(14,V2,12):: CALL CH
    AR(143,P$):: CALL CLEAR ::
    GOSUB 910
1160 NM=49 :: GOSUB 1730
1170 CALL CHAR(128,"3C7EEFFFFFFF
    7E3C"):: CALL CHAR(130,"3E7
    EECF8F8FC7E3C")
1180 C=13-INT(J/V2):: IF CH=3 TH
    EN C=13-INT((PR+O)/V2)
1190 NN,CO=C :: FOR E=V1 TO PR :
    : CALL HCHAR(12,C,42):: C=C
    +V1 :: NEXT E :: CALL HCHAR
    (12,C+V1,143):: C=C+3
1200 FOR E=V1 TO O :: CALL HCHAR
    (12,C,42):: C=C+V1 :: NEXT
    E :: RW=12
1210 PT=V1 :: CALL SPRITE(#10,12
    8,13,8*(RW-3),25,V0,20)
1220 CALL SOUND(-10,880,V0):: CA
    LL PATTERN(#10,129+PT):: CA
    LL POSITION(#10,X,Y)
1230 IF Y<240 AND Y>12 THEN PT=-
    PT :: GOTO 1220 ELSE CALL L
    OCATE(#10,8*(RW-V1)-V2,25)
1240 CALL SOUND(-10,880,V0):: CA
    LL PATTERN(#10,129+PT):: CA
    LL POSITION(#10,X,Y)
1250 IF ABS(Y-8*CO)<=16 THEN 126
    0 ELSE PT=-PT :: GOTO 1240
1260 FOR F=V1 TO PR :: CALL MOTI
    ON(#10,V0,V1):: CALL HCHAR(
    RW,CO,32)
1270 CALL LOCATE(#10,8*(RW-V1)-V
    2,8*CO-16):: CALL SOUND(70,
    110,V0):: CALL PATTERN(#10,
    128)
1280 N$=STR$(F):: CALL SAY(N$)::
     CALL PATTERN(#10,130)
1290 NM=NM+V1 :: CO=CO+V1 :: NEX
    T F :: CALL HCHAR(RW+V1,CO-
    V1,NM-V1):: NM=49
1300 CALL MOTION(#10,V0,V0):: CA
    LL LOCATE(#10,132,32):: FOR
     PP=V1 TO 200 :: NEXT PP
1310 CALL SPRITE(#V1,ASC(STR$(PR
    )),5,144,46):: CALL HCHAR(R
    W,CO+V1,32):: CALL HCHAR(RW
    +V1,CO+V1,143)
```

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```
1320 CO=CO+3 :: FOR F=V1 TO O ::
      CALL MOTION(#10,V0,V1):: C
     ALL HCHAR(RW,CO,32)
1330 CALL LOCATE(#10,8*(RW-V1)-V
     2,8*CO-16):: CALL PATTERN(#
     10,128):: CALL SOUND(70,110
     ,V0)
1340 N$=STR$(F):: CALL SAY(N$)::
      CALL PATTERN(#10,130)
1350 NM=NM+V1 :: CO=CO+V1 :: NEX
     T F :: CALL HCHAR(RW+V1,CO-
     O,NM-V1):: NM=49 :: CALL MO
     TION(#10,V0,V0)
1360 CALL LOCATE(#10,132,104)::
     FOR PP=V1 TO 200 :: NEXT PP
      :: CALL SPRITE(#V2,ASC(STR
     $(O)),5,144,118)
1370 CALL HCHAR(12,V1,32,32):: C
     ALL HCHAR(13,V1,32,32)
1380 C=NN :: FOR E=V1 TO PR :: C
     ALL HCHAR(12,C,42):: C=C+V1
      :: NEXT E :: CALL HCHAR(12
     ,C+V1,143):: C=C+3 :: FOR E
     =V1 TO O
1390 CALL HCHAR(12,C,42):: C=C+V
     1 :: NEXT E :: IF Z=V2 THEN
      1630 ELSE CALL SAY(STR$(PR
     ))
1400 FOR PP=V1 TO 400 :: NEXT PP
      :: CALL HCHAR(12,C-O-V2,14
     3)
1410 CALL HCHAR(12,C-O-V2,32)::
     CALL SAY("AND",,STR$(O))
1420 FOR PP=V1 TO 400 :: NEXT PP
      :: CALL HCHAR(12,C-O-V2,32
     ):: C=C-O-V2 :: CALL HCHAR(
     12,C,32,O+3)
1430 FOR E=V1 TO O :: CALL HCHAR
     (12,C-V1,42):: C=C+V1 :: NE
     XT E :: CALL SAY("IS",,STR$
     (J))
1440 CO=NN :: PT=V1 :: CALL SPRI
     TE(#10,128,13,8*(RW-3),25,V
     0,20)
1450 CALL SOUND(-10,880,V0):: CA
     LL PATTERN(#10,129+PT):: CA
     LL POSITION(#10,X,Y)
1460 IF Y<240 AND Y>12 THEN PT=-
     PT :: GOTO 1450
1470 CALL LOCATE(#10,8*(RW-V1)-V
     2,25)
1480 CALL SOUND(-10,880,V0):: CA
     LL PATTERN(#10,129+PT):: CA
     LL POSITION(#10,X,Y):: IF A
     BS(Y-8*CO)<=16 THEN 1500
1490 PT=-PT :: GOTO 1480
1500 FOR F=V1 TO J :: CALL MOTIO
     N(#10,V0,V1):: CALL VCHAR(R
     W,CO-V1,32,3):: CALL HCHAR(
     14,CO,NM)
1510 CALL LOCATE(#10,8*(RW-V1)-V
     2,8*CO-16):: CALL PATTERN(#
     10,128):: CALL SOUND(70,110
     ,V0)
1520 N$=STR$(F):: CALL SAY(N$)::
      CALL PATTERN(#10,130)
1530 NM=NM+V1 :: CO=CO+V1 :: NEX
     T F :: CALL HCHAR(12,CO-V1,
     32):: CALL MOTION(#10,V0,V0
     )
1540 CALL LOCATE(#10,132,176)::
     CALL SPRITE(#3,ASC(STR$(J))
     ,6,144,190):: FOR PP=V1 TO
     300 :: NEXT PP
1550 CALL HCHAR(14,V1,32,32):: P
     T=V1 :: CALL SPRITE(#10,128
     ,13,8*(RW-V1)-V2,8*CO+8,V0,
     20)
1560 CALL SOUND(-10,880,V0):: CA
     LL PATTERN(#10,129+PT):: CA
     LL POSITION(#10,X,Y):: IF (
     Y>=240)OR(Y<=20)THEN 1580
1570 PT=-PT :: GOTO 1560
1580 CALL DELSPRITE(ALL):: CALL
     CLEAR :: RETURN
1590 CALL CHAR(120,"000000000000
     FFFFFFF",122,"000000000000
     FFFFFFF"):: RETURN
1600 CALL COLOR(9,15,16)
1610 SC=ST+3*(PR-O):: FOR R=V1 T
     O O :: CALL VCHAR(10,3*(R-V
     1)+SC,97,V2):: CALL VCHAR(1
     0,3*(R-V1)+SC+V1,97,V2)
1620 NEXT R :: FOR D=V1 TO 32 ::
      CALL VCHAR(13,D,32,5):: NE
     XT D :: RETURN
1630 CALL HCHAR(12,NN+PR+V1,32):
     : CALL COLOR(14,10,B):: CAL
     L CHAR(142,"001E7E7E7E7C78"
     ):: LA=NN+PR+O+V2
1640 BR=NN+PR-O :: CALL SAY(STR$
     (PR)):: FOR E=V1 TO O :: CA
     LL HCHAR(12,LA,32):: CALL H
     CHAR(13,BR,142):: LA=LA-V1
1650 BR=BR+V1 :: NEXT E :: BR=BR
     -V1 :: FOR PP=V1 TO 400 ::
     NEXT PP :: FOR E=V1 TO O
1660 CALL HCHAR(13,BR,32):: CALL
      HCHAR(12,BR,142):: BR=BR-V
     1 :: NEXT E :: CALL COLOR(1
     4,12,B)
1670 FOR PP=V1 TO 400 :: NEXT PP
      :: CALL COLOR(14,16,B):: C
     ALL SAY("TAKE A1 WAY",,STR$
     (O)):: CALL COLOR(14,V1,B)
1680 CALL SAY("IS",,STR$(J)):: G
     OTO 1440
1690 CALL SAY(STR$(PR),,"TAKE A1
      WAY",,STR$(O),,"IS",,STR$(
     J)):: RETURN
1700 X$="GOOD!!!" :: CALL SAY("G
     OOD WORK"):: RETURN
1710 CALL HCHAR(20,PL,134):: CAL
     L COLOR(10+I,CL,B):: CALL S
     OUND(-99,440,28):: CALL KEY
     (V0,X,Y)
1720 IF Y=V0 THEN CALL HCHAR(20,
     PL,32):: CALL COLOR(10+I,CP
     ,B):: CALL SOUND(-99,880,28
     ):: GOTO 1710 ELSE RETURN
1730 CALL SCREEN(B):: CALL COLOR
     (V1,B,B,V2,14,B,13,9,B,3,V2
     ,16,4,V2,16):: RETURN
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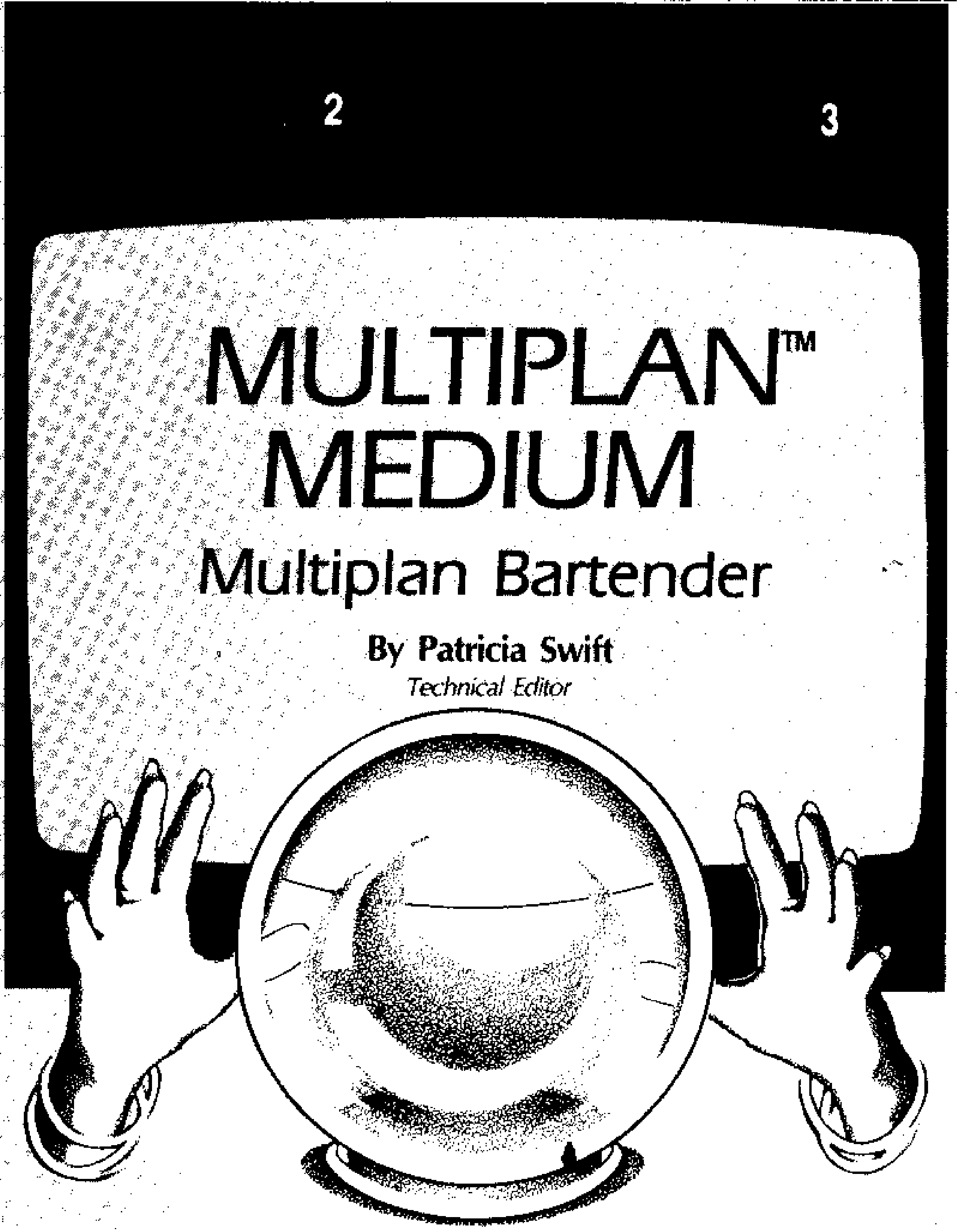
MULTIPLAN™ MEDIUM

Multiplan Bartender

By Patricia Swift
Technical Editor



This column is an ongoing tutorial on the *Multiplan* software package. To obtain full benefits from this column, a newcomer to *Multiplan* may find it useful to read the previously printed columns.

In exploring the many uses for *Multiplan,* this series has touched on such mundane tasks as balancing our checkbooks and calculating income taxes. This month we present something more interesting and possibly more useful—a model for home bartenders.

Long-time readers of *99'er HCM* will remember the *Micro Bartender* program in TI BASIC which appeared in Volume 1, Number 4. *Micro Bartender* gave you a way to store drink recipes in the computer. You could also tell the computer what ingredients you had on hand, and it would show you what drinks you could make.

This month's model performs the same type of service, using *Multiplan* instead of BASIC. First put your drink recipes in the model. Then enter your ingredients on hand; *Multiplan* puts a star by the drinks you can make. This model does not draw drinks on the screen as the *Micro Bartender* did, but *Multiplan* is much easier to construct than the old program in BASIC.

The Idea Behind the Model

Figure 1 shows the finished printed model. First of all, the model needs recipes for the drinks you want to make. The table shows the names of drinks across the top and their ingredients of the left side. The body of the table contains the quantity of each ingredient to be used for each drink. The units of each ingredient can be anything; you might use ounces for some and actual numbers for others (e.g., orange juice as ounces and limes as whole fruits). Just be consistent in the type of unit you use in any single row in the drinks table.

Once you have entered and saved your table, you can use that portion of the model to look at recipes for drinks. But that is only part of the function of this model. The other purpose is to show what drinks can be prepared from the ingredients on hand in column 1. *Multiplan* will put ** in row 1 above the name of each drink which can be made from these ingredients.

A given drink can be made only if the required amount of each of its ingredients is on hand. The converse of this statement is also true: a given drink cannot be made if one or more of its required ingredients is not on hand in sufficient quantity. Consider the decision process for just one of the drinks in the drink table. We want *Multiplan* to compare the amount of each ingredient below the name of the drink to the amount of the corresponding ingredient in the on-hand column. If all six (for each of the six ingredients in the model) of these comparisons are successful, then *Multiplan* should put ** above the name of the drink; if one or more of the comparisons is not successful, then *Multiplan* should put blanks above the name of the drink. Apply the same logic to all the drink columns, and the model is complete.

Multiplan has a powerful IF statement which we need to use in the first row of the model. The syntax of the IF statement is: IF (*condition, value-if-true, value-if-false*). This is the perfect statement for each cell in row 1 above a drink. We want to say IF (drink can be be made," ** "," "); that is, if the drink can be made, put ** in this cell; otherwise put 2 blanks in this cell. With this statement, we only have to fill in the condition, and *Multiplan* can evaluate whether the drink can be made.

Multiplan handles the six comparisons for each drink in a straightforward fashion: Just compare the required ingredient cell in the drink column to the cell on the same row in the on-hand column. It is intriguing to see how the model combines the information on each of the six comparisons to arrive at the final decision of whether the drink can be made or not.

We could have used a very long condition in the IF statement at the top of each drink column, such as: IF (*enough of first ingredient* AND *enough of second ingredient* AND *enough of third ingredient* AND. . . AND *enough of sixth ingredient,* "**"," "). But if this looks cumbersome in English, just think how bad it would be in *Multiplan*-ese with its row-and-column notation. And what if you wanted to expand your drinks table and list of ingredients? Of course there has to be a better way.

The model uses a "work table" to hold the result of each comparison. There is a cell in the work table corresponding to each cell in the drinks table. When an ingredient required for a drink is compared to the corresponding ingredient on hand, *Multiplan* places the result of the comparison in the work table. This result is derived from the following rule: If there is enough of the ingredient, put a 0 in the work table; if there is not enough, put a 1 in the work table. With this strategy, a drink for which all ingredients are on hand would have all 0's in its column in the work table after all the comparisons have been made. If we sum the column for a drink in the work table, this sum will be 0 for possible drinks and greater than 0 for impossible drinks (because there will be at least one 1 in the work table). In fact, this sum of the work table column will be exactly the number of missing ingredients for each drink. These column sums are in the last row of the work table.

Continued

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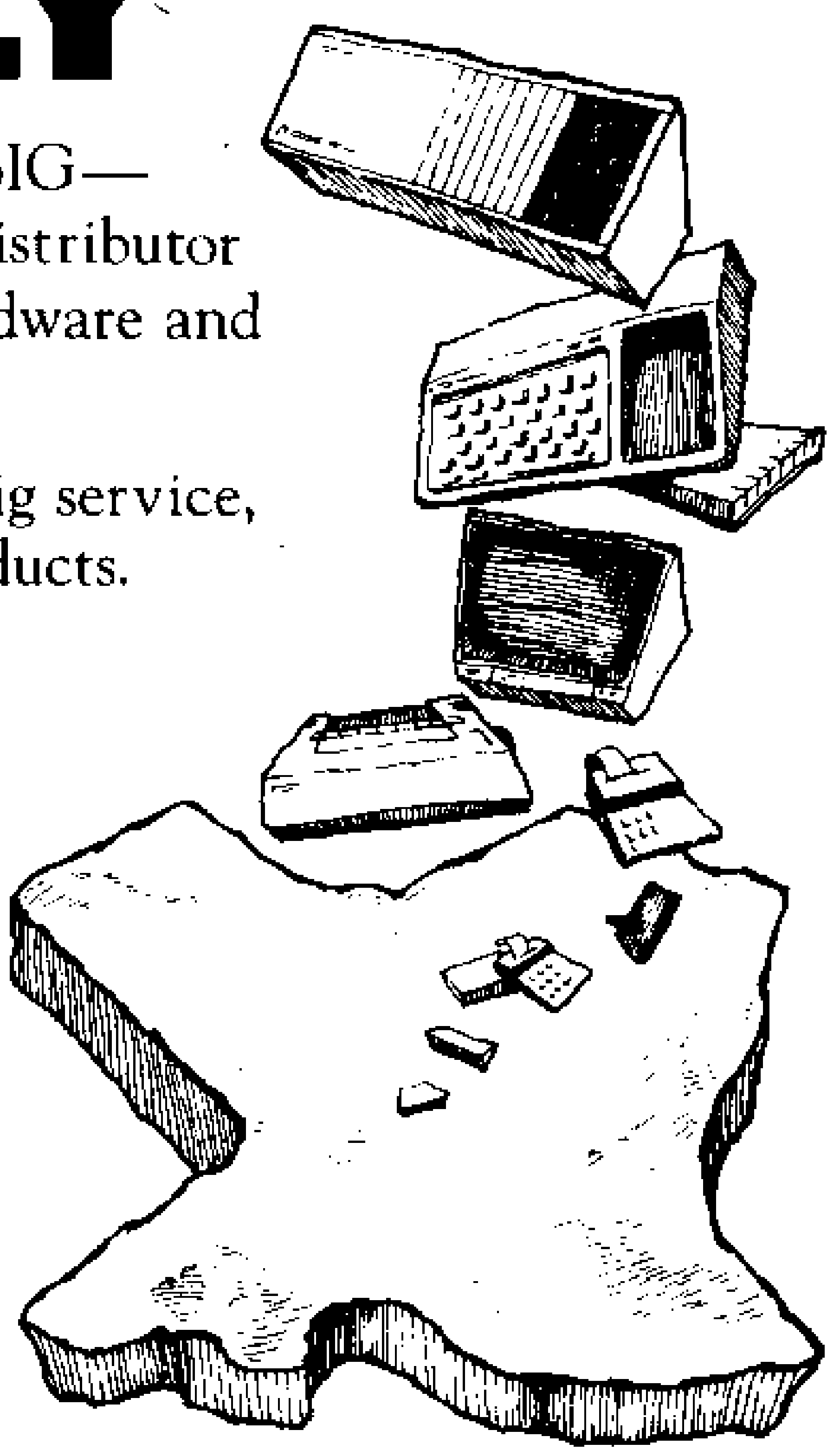

Now the IF statement at the top of each drink column becomes very simple: IF (*sum of same column in work table* = 0, "**"," ").

Constructing the Model

Figure 1 shows a printout of the finished model, and Figure 2 shows the formulas. They should help you in constructing the model. My columns were ten characters wide throughout the model. To duplicate it, start out by changing the default column width to 10 via the Format Default command. You will save time if you turn off the recalculation feature via the Options command while you are entering the model.

The entry of the drinks table itself is the most time-consuming part of the model and should be done next. The drinks and ingredients can be placed in any order you like; it doesn't matter to *Multiplan*. In the column under each drink, put the quantity of each ingredient used in that drink, remembering to be consistent in the use of units in each row. If your drinks table has many different units, you might want to indicate the units as part of the ingredient names to avoid confusion later. Refer to Figure 1, and notice that the drinks table has its upper left corner at row 3 column 2 to leave room for the on-hand table and the asterisks showing which drinks can be made.

Next enter the heading HAVE NOW: in row 4 column 1 and define the on-hand table so we can refer to it later. Use the Name command to assign the name TAB1 to the on-hand table, namely R5C1:R10C1.

Set off the work area from the rest of the worksheet by filling R11C1 with dashes. Then Copy that cell 6 cells to the Right. Then put the label WORK TABLE: in R12C2. These items are basically comments to make the model easier to use later on.

Next set up the work table. Start with R12C3. This cell will be the work cell corresponding to the first ingredient for the first drink. The cell should contain 0 if there is enough of this ingredient on hand to make this drink; otherwise, the cell should contain 1. The formula for this cell is IF (R[-7]C<=INDEX (TAB1,ROW( )-11),0,1). In other words, compare the contents of the cell which is seven rows above this work cell to the contents of the cell in TAB1 on the same row; if the drink cell's number is less than or equal to the amount on hand, then put 0 in the work cell; otherwise, put 1 in the work cell. Because the work table is the same shape as the drinks table, the expression R[-7]C will give the corresponding cell of the drinks table for every position of the work table. The expression INDEX (TAB1,ROW( )-11) for the cell in the on-hand table to compare against needs some explanation. ROW( ) means "the number of the row where this formula resides." When this formula is placed at R12C3, ROW( ) is evaluated as 12. Thus for the cell we are building, ROW( )-11 comes out to 1. Then INDEX (TAB1,1) means just the first cell of TAB1, that is, the amount of the first ingredient on hand. You might wonder why we didn't use the more common expression R[-7]C[-2] to indicate the amount of the first ingredient on hand. This expression would work fine for the first column in the work table (that is, the first drink), but it would be incorrect for the second drink because it would point to the ingredient names instead of to the amounts on hand.

After you enter the formula in R12C3, it is very easy to construct the rest of the work table. Since there are six ingredients, Copy that cell Down for 5 cells. Then put the label # MISSING at R18C2, and put the formula Sum (R[-6]C:R[-1]C) in R18C3. This formula adds the column in the work table to show if there are any ingredients missing for that drink.

The rest of the work table consists of four more columns that look exactly like the one we just finshed. Use the Copy Right command to copy 4 columns starting at R12C3:R18C3. And now for the crowning touch. Make R1C1:R1C2 continuous (via the Format Cells command), and then fill in the comment YOU CAN MAKE THESE. Then move over to R1C3 and enter the formula IF(R[+17]C=0,"**"," "). R[+18]C is just the location of the sum cell in the work table, and the formula says that if this sum is 0, *Multiplan* should display ** here; otherwise it should leave this cell blank. Because this formula will work for all drinks, simply Copy it Right for 4 cells.

That's all there is to it! Be sure to Transfer Save this model, and then try out some combinations of ingredients on hand.

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Figure 1: Printout for the Model

```
    1             2          3          4        5        6        7
1  YOU CAN MAKE THESE:      **         **                          **
2
3                      MARGA-     SCREW-   RUM      BLOODY   VODKA
4  ON HAND             RITA       DRIVER   PUNCH    MARY     SCRWDRVR
5   3        OR JUICE                3        4                  3
6   0        TO JUICE                                  3
7   1        LIME                            0.5
8   1        TEQUILA         1
9   1        RUM                     1        1
10  1        VODKA                                    1.5        1
11 ___________________________________________________________________
12          WORK TABLE       0       0        1        0         0
13                           0       0        0        1         0
14                           0       0        0        0         0
15                           0       0        0        0         0
16                           0       0        0        0         0
17                           0       0        0        1         0
18          # MISSING        0       0        1        2         0
```

Figure 2: Formulas for the Model

```
    1             2          3          4        5        6        7
1  YOU CAN MAKE THESE:   IF(R[+17]C=0,"***","  ")
2
3                      MARGA-     SCREW-   RUM      BLOODY   VODKA
4  ON HAND             RITA       DRIVER   PUNCH    MARY     SCRWDRVR
5   3        OR JUICE                3        4                  3
6   0        TO JUICE                                  3
7   1        LIME                            0.5
8   1        TEQUILA         1
9   1        RUM                     1        1
10  1        VODKA                                    1.5        1
11 ___________________________________________________________________
12          WORK TABLE   IF(R[-7]C<=INDEX(TAB1,ROW( )-11),0,1)
13
14
15
16
17
18          # MISSING          SUM(R[-6]C:R[-1]C)
```

Don't forget to turn the Recalc option back on if you turned it off earlier.

It is easy to expand the drinks and ingredients tables. To add new ingredients, Insert Rows after row 10 to make room. Then use the Name command to lengthen TAB1. Insert the same number of rows after what is now row 17 to lengthen the work table. Edit the formula in the upper left cell of the work table so that the expression INDEX (TAB1,ROW( )-11) uses the offset appropriate to your new table sizes instead of 11 (e.g., if you add two ingredients, then this offset should become 13). Copy this new formula Down for the total number of ingredients minus 1. Revise the SUM formula in the last row of column 3 to sum the longer work column, and then Copy the first work column 4 columns to the Right. To add new drinks without adding new ingredients, add them to the drinks table starting in column 8. Then copy existing cells in row 1 and in the work table to fill out the new model.

Conclusion

This model demonstrates two important *Multiplan* concepts: (1) the IF statement and a way to use work tables to hold intermediate results, and (2) how to turn your problem into terms *Multiplan* can understand.

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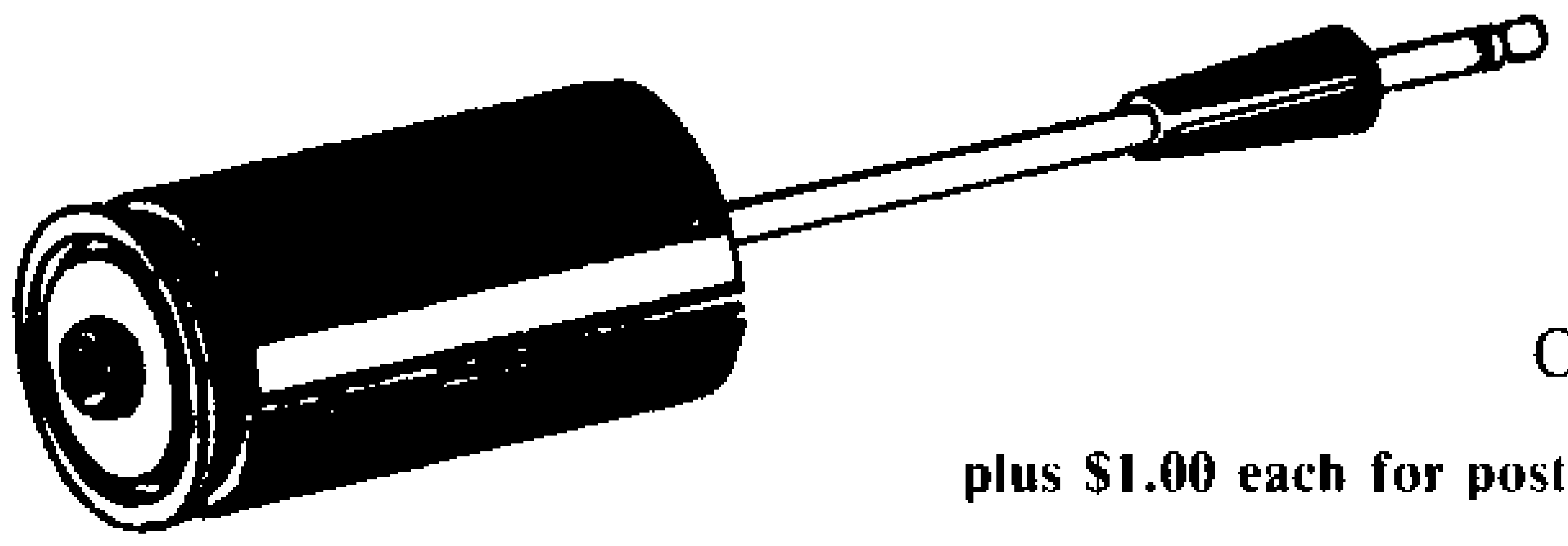

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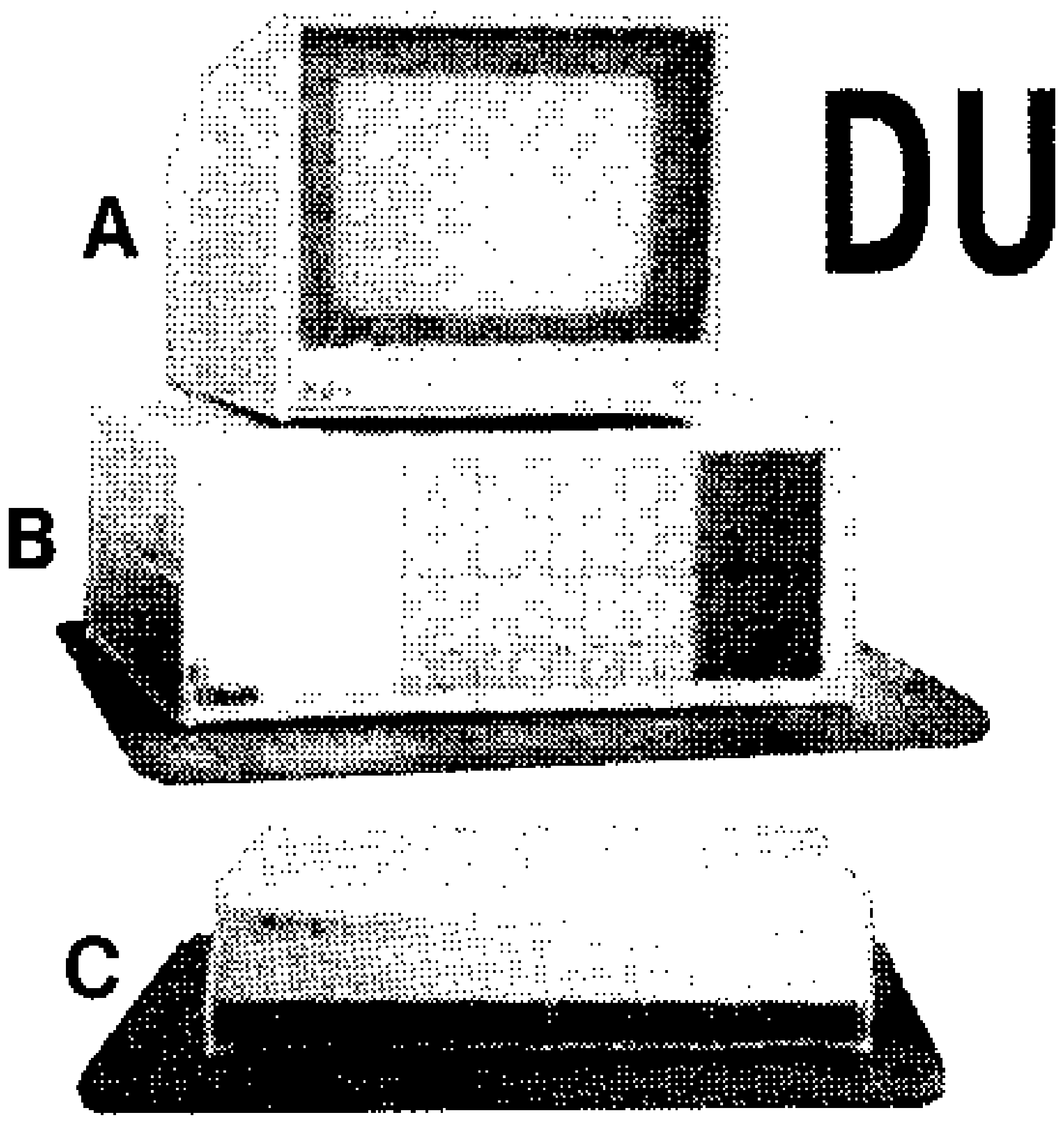

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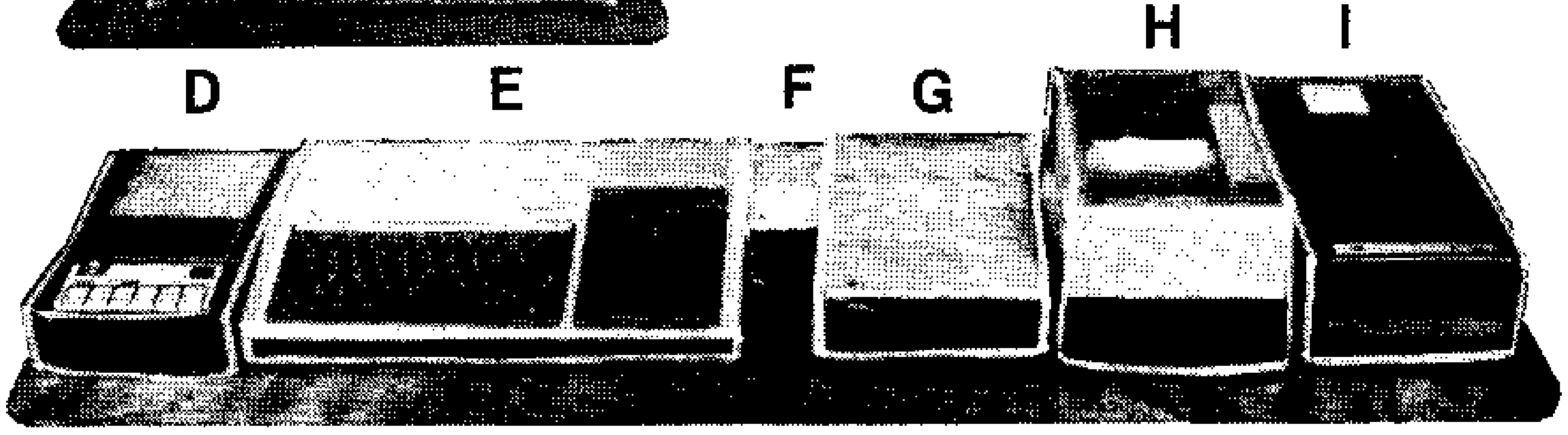

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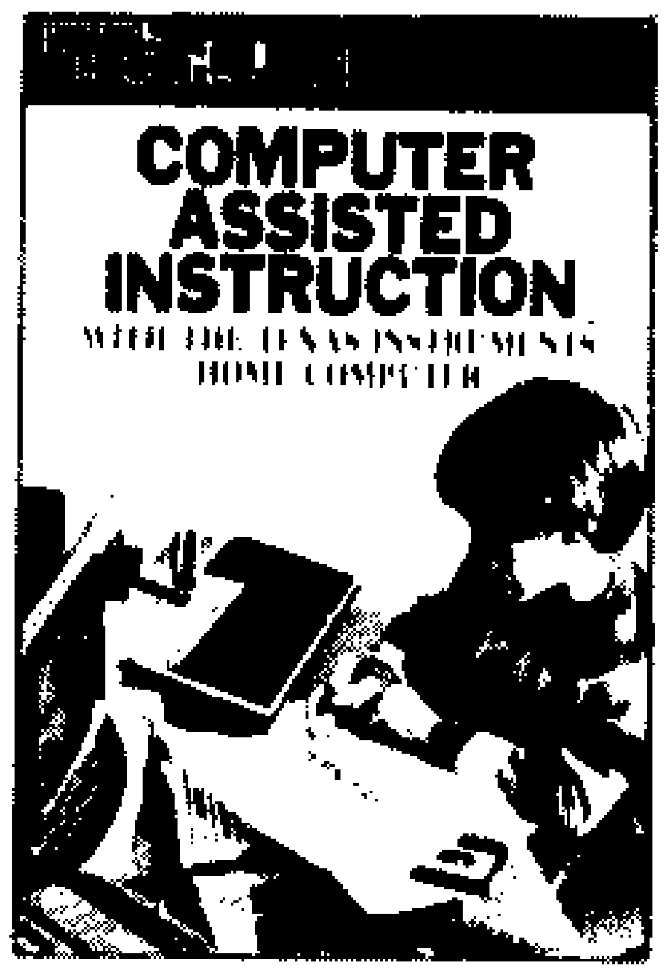
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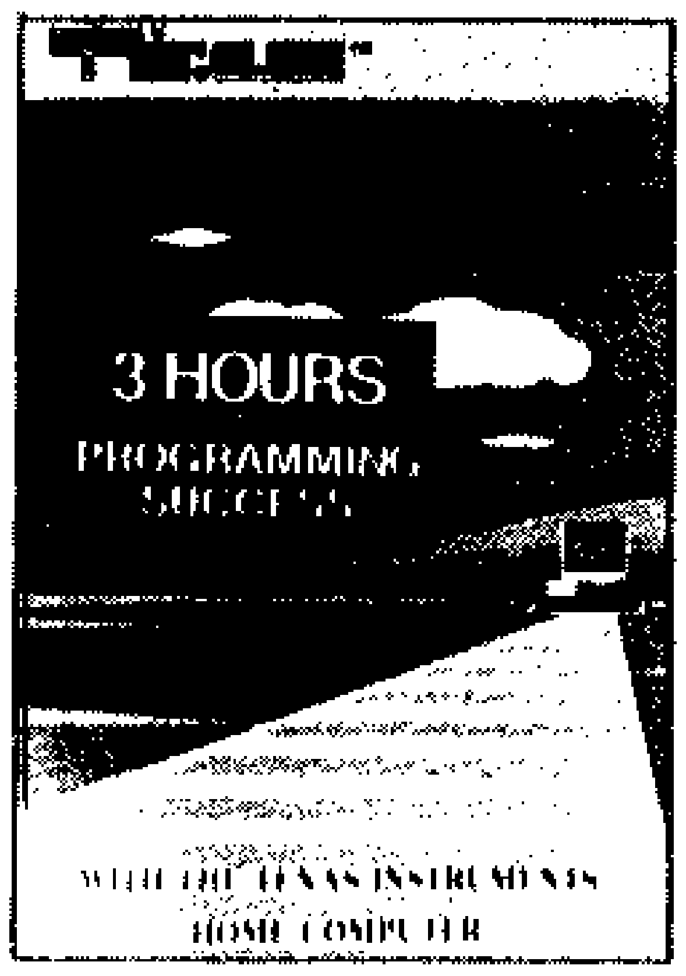

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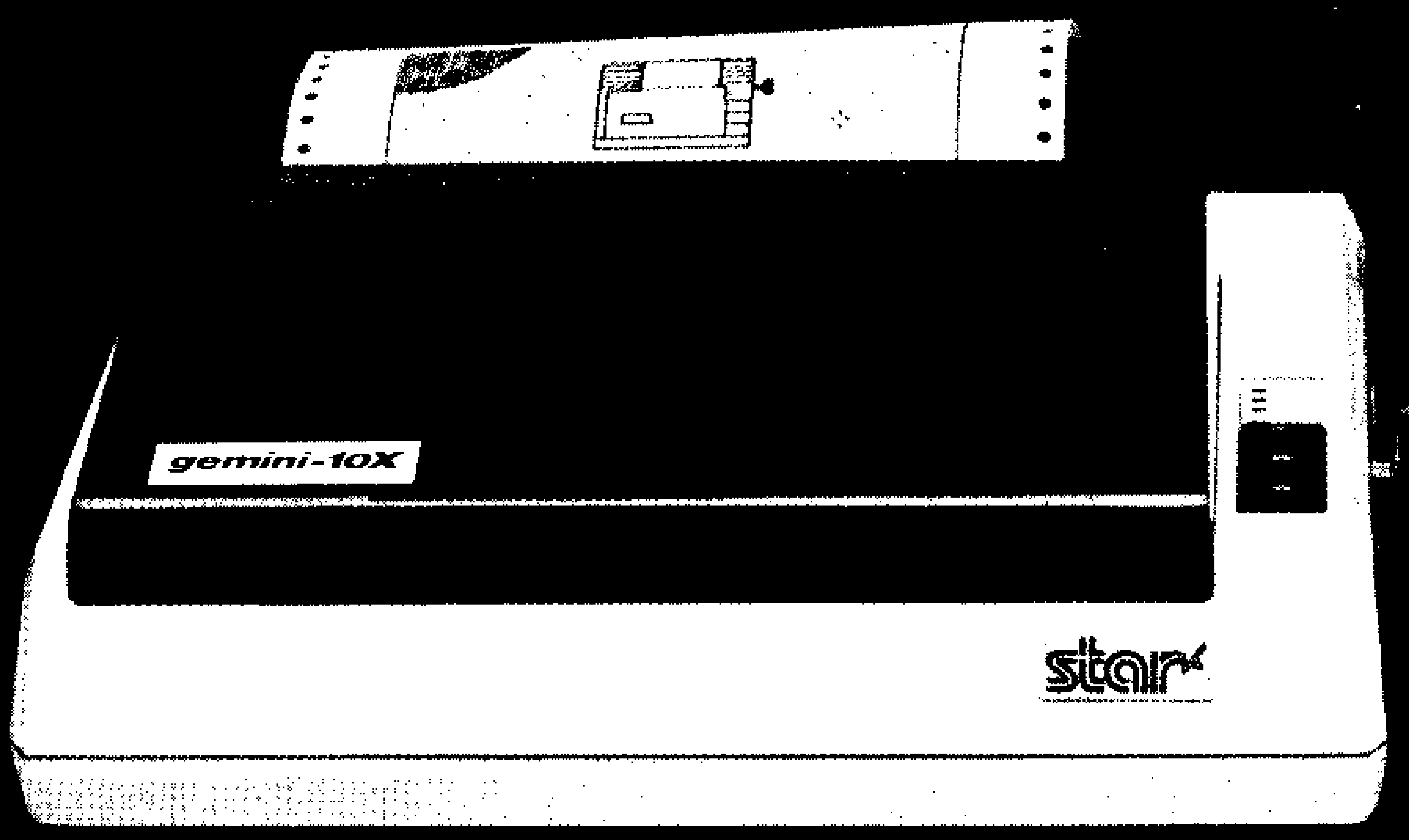

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